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Introduction

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02 AIRCRAFT
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **763**

03 AUXILIARY SYSTEMS
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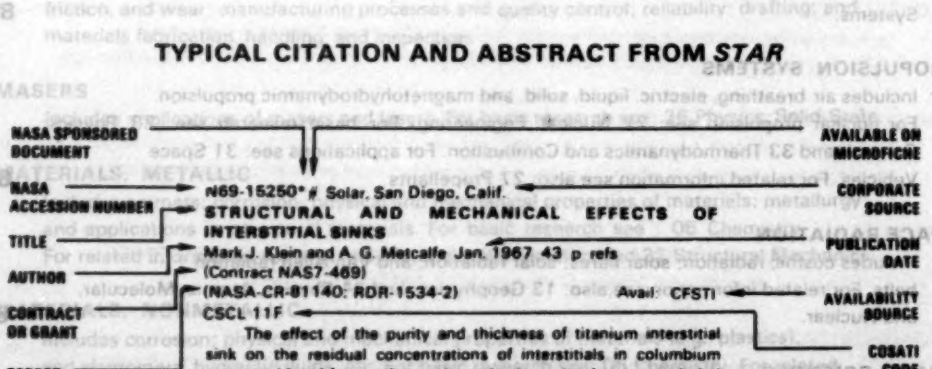
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N69-15250* # Solar, San Diego, Calif.
STRUCTURAL AND MECHANICAL EFFECTS OF INTERSTITIAL SINKS
Mark J. Klein and A. G. Metcalfe Jan. 1967 43 p refs
(Contract NAS7-469)
(NASA-CR-81140; RDR-1534-2)
Avail: CFSTI
CSCL 11F
The effect of the purity and thickness of titanium interstitial sink on the residual concentrations of interstitials in columbium was considered from a thermodynamic viewpoint. It was concluded that the equilibrium concentrations of interstitials in columbium is not a sensitive function of these parameters. The structure and hardness of Ti/D-43 diffusion couples were correlated with the partitions of interstitials between the two metals. A reduction in the oxygen and carbon concentration in the D-43 correlates with an increase in the grain size and a change in the grain morphology of this alloy. The equilibrium partition of interstitials between the titanium and the D-43 is believed to account for an increase in the hardness of the titanium, but this partition does not seem to affect the hardness of the D-43. Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-15061 Illinois Univ., Urbana.
BLADE CHANNEL FLOW IN A SIMULATED RADIAL-FLOW TURBOMACHINE
Robert Calvin Hansen (Ph.D. Thesis) 1967 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-8096

The channel flow patterns were observed in a stationary model, and the static pressures were measured with a monometer while the flow speeds were measured with a hot wire anemometer. This model was a 6-blade segment of an 18-blade annular, radial-inflow cascade. One wall was plane, the other was contoured, so that the circumferential area between was constant at all radii. Three rotational speeds (zero, intermediate, and high) were simulated by different model blade shapes. Differences in flow patterns among the three blade shapes were minor. The consequences of this study are summarized as follows: (1) The shapes of a radial-flow turbine's walls should be designed on the basis of the total flow velocity and attainable diffusion rather than on the current method based on considering only the radial component of the velocity, (2) secondary flows due to upstream and internally developed transverse vorticity can be predicted reasonably well, and (3) blade surface boundary layer development and separation needs further study. Dissert. Abstr.

N69-15162 Oklahoma State Univ., Stillwater.
EFFECTS OF A WINGTIP-MOUNTED PROPELLER ON WING LIFT, INDUCED DRAG, AND SHED VORTEX PATTERN
Melvin H. Snyder, Jr. (Ph.D. Thesis) 1967 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-8500

Experimental investigations of the use of end-plates to control and to vary the wing lift distribution and induced drag are reviewed and analyzed. An experimental investigation of a reflection-plane wing with a nacelle and propeller mounted at the wingtip is reported. Two types of propellers were used. Three-component balance measurements were made as well as a tuft-grid survey of the flow field downstream of the wing. It was shown that end-plates increase the wind effective aspect ratio; however, the same structure could be used more effectively as spanwise extensions of the wing surface. Energy may be employed to affect the wing flow field, lift distribution, and induced drag by mounting the aircraft's propellers at the wingtips. The smallest furrows were made by openers with large horizontal and small vertical angles. The largest furrows were made by openers with small horizontal angles and medium vertical angles. Dissert. Abstr.

N69-15200 Royal Aircraft Establishment, Farnborough (England).
LIFT AND VORTEX DRAG DUE TO FLAPS ON THIN, SWEPTBACK WINGS IN INVISCID INCOMPRESSIBLE FLOW
J. McKie Sep. 1968 22 p refs Presented at the DGLR Conf., Berlin, 1 4 Oct. 1968
RAE-TM-AERO-1097; B-835) Avail: CFSTI

A method is given for estimating lift and vortex drag increments due to part-span flaps on thin, sweptback, tapered wings in inviscid, incompressible flow. It can be considered as a simple extension of the R.A.E. Standard Method for calculating spanwise loadings on such wings, and retains similar means for accounting for aspect ratio, sweepback, tip and centre effects. Spanwise loadings are obtained by Multhopp's quadrature methods, and examples are given for typical wing layouts. Author

N69-15231*# Polytechnic Inst of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.
THE THREE-DIMENSIONAL WAKE BEHIND AN OBSTACLE ON A FLAT PLATE
Robert F. Mons and Pasquale M. Sforza Jun. 1968 71 p refs Sponsored in part by NASA
(Contract AF 49(638)-1623; Proj. 9781-01)
(NASA-CR-98920; AD-675243; AFOSR-68-1666; PIBAL-68-20) Avail: CFSTI CSCL 20D

An investigation of the three-dimensional, incompressible wake behind a blunt obstacle located at the leading edge of a flat plate is presented. Configurations studied included the 'clean' flat plate, and the flat plate with a rectangular, a square, or a two-dimensional obstacle fitted to the leading edge of the plate. Experimental results are compared to a mathematical model based on the Oseen linearization for diffusive flows. Based on mean flow measurements, a transition to turbulent flow was not encountered for any of the configurations examined. Such wakes are characterized by a region of strong vorticity immediately behind the obstacle followed by a region of viscous diffusion. Bulk properties of the wake-like flow and the applicability of the theoretical model were found to be highly dependent on the geometry of the obstacle. Author (TAB)

N69-15290 Princeton Univ., N. J.
EXPERIMENTAL STUDIES OF A LAMINAR HYPERSONIC CONE WAKE
Earll Morton Murman (Ph.D. Thesis) 1967 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-8953

An experiment was conducted which is representative of the wake flow for a hypersonic Mach number–flow Reynolds number flight condition. A 10° half-angle sharp cone was magnetically suspended in a Mach sixteen helium stream. A conventional hypersonic wind tunnel of long test duration generated the flow and provided the basis for an experiment which was purely fluid mechanical in nature. The cone model was at the adiabatic wall temperature and zero angle of attack. The free-stream Reynolds number based on the one inch cone base diameter was 121,000. Data obtained for the near wake region in the present experiment reveals several interesting features. The base pressure is higher than the freestream ambient level. There is no appreciable extent of constant axial static pressure in the base flow region. A maximum axial static pressure of 2.4 p_∞ was found at Z = 0.75D.
Dissert. Abstr.

N69-15294 National Aerospace Lab., Tokyo (Japan).
AN INVESTIGATION ON CONTROL-SURFACE BUZZ AT TRANSONIC SPEEDS
Yasuharu Nakamura 1968 49 p refs In JAPANESE; ENGLISH summary
(NAL-TR-155) Avail: CFSTI

Two types of control-surface buzz occurring at transonic speeds are investigated experimentally and theoretically with special reference to small amplitude oscillations. Two dimensional models of aerofoil–flap combination were used for the experimental investigations. A free oscillation method was adopted in order to obtain the unsteady hinge moment for small amplitude oscillations. Optical observations of the flowfield around the models during the growth of buzz were also made with high speed schlieren cinematography. The results may be summarized as follows: (1) For a control-surface buzz at low supersonic speeds, optical observations indicate that the shock waves remain attached at the trailing edge of the flap during small amplitude oscillations, and it is concluded that the supersonic potential flow over the flap is responsible for its onset. (2) For a control-surface buzz occurring when the shock waves form upstream of the flap at high subsonic speeds, the effects of frequency parameter and Reynolds number on the buzz characteristics were studied experimentally. It is shown that the onset of instability is essentially associated with the separated flow behind the shock waves.
Author

N69-15394# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERODYNAMIC CHARACTERISTICS OF ANNULAR JET FLOW OVER A SCREEN
V. I. Khanzhonkov 27 Dec. 1967 46 p ref Transl. into ENGLISH from Tsentr. Aero-Gidrodinam. Inst., Prom. Aerodinam. (Moscow), no. 27, 1966 p 145–179
(AD-678466; FTD-MT-24-227-67) Avail: CFSTI CSCL 20/4

A detailed experimental investigation of the aerodynamic characteristics of annular jets impinging on a screen is presented. Knowledge of the interactions of annular and plane jets with the ground which generate a lift force should be of prime interest to the design of air cushion vehicles. Six different annular nozzle configurations were investigated: (1) three with an annulus width b = 8 mm and angles of inclination phi = 0,30 and 45 deg with respect to the vertical; (2) two with an annulus width b = 20 mm with angles of inclination phi = 0 and 45 deg; and (3) one with an annulus width b = 25 and angle phi = 30 deg. The design details of the nozzles are described and geometrical dimensions are given. The technique used for interpretation of the experimental data and measuring techniques are also described.
Author (TAB)

N69-15587 Bolkow Entwicklungen K. G., Munich (West Germany).
CALCULATION OF FRICTION FREE HYPERSONIC FLOWS OVER ELONGATED BLUNT ROTATIONAL BODIES WITH REGARD TO EFFECTS OF REAL GASES [BERECHNUNG DER REIBUNGSFREIEN HYPERSCHALLSTROEMUNG UM LANGGESTRECKTE STUMPFE ROTATIONSKOERPER MIT BERUECKSICHTIGUNG VON REALGASEFFEKTEN]
Peter Mittelbach 4 Oct. 1968 27 p refs In GERMAN
Presented at the WGLR Fachtagung Ueber Aerodynamik, 1–4 Oct. 1968
(FM-399-0) Avail: Issuing Activity

Integral relations are used to find approximate solutions for equilibrium and frozen flow around blunt bodies of revolution moving at hypersonic speed through the air. Real gas equations are considered the thermodynamic properties of air in chemical equilibrium.
Transl. by G.G.

N69-15673# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FLUID MECHANICS (SELECTED ARTICLES)
8 Nov. 1967 35 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Izv. Mekhan. Zhidkosti i Gaza, no. 6, 1966 p 74–80 and 118–123
(AD-678423; FTD-HT-23-742-67) Avail: CFSTI CSCL 1/3

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2. HYPERSONIC STREAMLINING OF TAPERED BLUNTED EDGE BY A NONUNIFORM GAS FLOW B. A. Zemlyanskiy p 10–19 refs (See N69-15675 05-01)

N69-15674# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FEATURES INVOLVED IN THE CALCULATION OF THE STREAMLINING OF WINGS EXHIBITING COMPLEX PLANFORM AT SUBSONIC VELOCITIES
S. M. Belotserkovskiy *In its* Fluid Mech. 8 Nov. 1967 p 1–9 refs (See N69-15673 05-01)
Avail: CFSTI

Special features characterizing the calculation of main and distributed aerodynamic characteristics of complex monoplane wings such as: wings with discontinuities in leading and trailing edges, with curvilinear edges, and wings with variable geometry are considered. The effects of geometrical parameters and the Mach number on the aerodynamic characteristics of these wings are analyzed by using the method developed by the author in his three previous works, where the continuous vortex layer is replaced by a discrete system of oblique, horseshoe shaped vortices. The problem of steady motion of a wing with no slip at an angle of attack is considered and expressions for induced drag for wings with sharp and profiled leading edges are established. As an example the proposed technique is used to calculate subsonic flows past two most characteristic shapes, that is a variable-geometry F-111 wing and a "Concorde" type wing.
Author

N69-15675# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HYPERSONIC STREAMLINING OF TAPERED BLUNTED EDGE BY A NONUNIFORM GAS FLOW
B. A. Zemlyanskiy *In its* Fluid Mech. 8 Nov. 1967 p 10–19 refs (See N69-15673 05-01)
Avail: CFSTI

An approximate approach is used in the investigation of non-uniform gas flow in a compressed layer between a blunted leading edge and the internal compression jump formed just ahead of the edge. For simplicity, the edge is assumed to be cylindrical. The solution is sought by a method based on the construction of

streamlines which is not bound by assumptions on the character of flow in the compression layer. The solution for an oblique leading edge is obtained in a simple, analytical form that makes it possible to determine the shape of the internal jump and profiles of all flow parameters across the layer. The results of calculations in the case of a cylinder with spherical bluntness in equilibrium dissociating air flow at $U_\infty = 7.5$ km/sec, $p_\infty = 3.3 \times 10^{-7}$ g/cm^3 and in perfect gas flow at $M_\infty = \infty$, $\gamma = 1.4$ are given in graphs. They show that the flow is strongly vortical near the edge and, in particular, in the presence of dissociation and in the region of incidence of the bow shock wave on the edge. A simple approximate method of characteristics is outlined for the case of supersonic flow in the compressed layer taking place when the angle of sweep is sufficiently large. Author

N69-15861 Sud Aviation, Paris (France).
STUDY OF THE STABILITY OF A FUSE SONDE AS A FUNCTION OF THE OGIVE LENGTH AND ITS MASS [ETUDE DE LA STABILITE D'UNE FUSEE-SONDE EN FONCTION DE LA LONGUEUR DE L'OGIVE ET DE SA MASSE]
[1968] 35 p In FRENCH Presented at AFITAE 5th Appl. Aerodyn. Colloq., Poitiers, France, 6-8 Nov. 1968
Avail: Issuing Activity

The two-stage sounding rocket ERIDAN, which has a diameter of 500 mm and whose second stage is the DAUPHIN, was studied. The ERIDAN was to meet the following specifications: high performance; acceptable dispersions with neither manned nor unmanned guidance; a large range of mass, volume and CG location of the payload, which would permit a great number of different scientific experiments; and low cost, maximum use of interchangeable elements. These conditions led to the choice of identical rectangular fins for both stages with additional stub wings for certain special payloads. The theoretical and experimental aerodynamic study of these configurations in the transonic and high supersonic region showed that the calculated lift coefficients and aerodynamic centers were very close to those measured in the tunnel. The effect of the stub wings upon the static stability and the drag of both the second stage alone and the whole rocket was studied and compared with the effect of an increase of fin span. The first flight results obtained on DAUPHIN have confirmed the longitudinal stability predicted by calculation and wind tunnel tests.
Author

N69-15897*# Aztec School of Languages, Inc., Acton, Mass.
INFLUENCE OF THE RADIAL GAP OF THE TURBINE BUCKETS ON THE EFFICIENCY OF MULTI-STAGE TURBINES [DER EINFLUSS DES RADIALEN SCHAUFELSPALTES AUF DEN WIRKUNGSGRAD MEHRSTUFIGER TURBINEN]
Dietrich Hartmann (Ph.D. Thesis—Tech. Hochschule Hannover, West Ger.) Washington NASA Nov. 1968 116 p refs Transl. into ENGLISH from German Thesis
(Contract NASw-1692)
(NASA-TT-F-11954) Avail: CFSTI CSCL 20D

The loss producing flow processes at the radial gap between the rotating buckets and the housing of a turbine result in decreased efficiency. The effects of the gap on efficiency and flow at the bucket tips are investigated in an experimental air turbine having 1 to 7 turbine stages, by varying gap widths, mass flow, and rotational speed as well as by use of a straight lattice with the gap in the lattice channel. While experiments using the straight lattice determined the dependence of flow processes on lattice geometry, experiments with the experimental turbine served to determine the influence of those parameters which are characteristic for the particular conditions in a multistage turbine. Author

N69-15900*# Techtran Corp., Glen Burnie, Md.
AERODYNAMIC MEASUREMENT TECHNOLOGY: PROCEEDINGS OF THE FIRST MEETING OF THE SUBCOMMITTEE ON AERODYNAMIC MEASURING TECHNOLOGY [BERICHT UEBER DIE SITZUNG DES UNTERAUSSCHUSSES AERODYNAMISCHE MESSTECHNIK]
Alfred Heyser Washington NASA Jan. 1969 199 p refs Transl. into ENGLISH from German Report WGL-5/1962 Conf. Held in Aachen, West Ger., 26 Apr. 1962
(Contract NASw-1695)
(NASA-TT-F-11856; WGL-5/1962) Avail: CFSTI CSCL 01A

The status of German aerodynamic measurement technology is described with particular reference to the historical background and causative factors explaining the relative lag in the technology. The conference also included eight papers on pressure measurement and pressure measurement devices as applied to this technology, and excerpts from these follow. A general review of pressure measuring instruments for subsonic wind tunnels was presented. Various pressure instruments designed for performing measurements in supersonic wind tunnels are described and diagrammed. Following a definition of pressure terminology for subsonic and supersonic flow fields, various designs of pitot tubes, static, dynamic, and direction-of-flow pressure probes are mentioned. The possibilities and methods are considered of determining the Mach number by means of various parameters such as pressure condensity, temperature, velocity, and wave geometry. Pressure distribution measurements were made in intake studies. Turbulent wall shear stress and the velocity vector were measured. A water-cooled probe to determine the flow direction was developed as a measuring device for research in reaction engine power plant combustion chambers. B.P

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-15346# Tennessee Univ., Tullahoma. Space Inst.
GOVERNING EQUATIONS FOR WAVE PROPAGATION IN A HOMOGENEOUS, ISOTROPIC, CONTINUOUS FLUID
William C. Sperry (FAA) Feb. 1968 46 p refs Presented at Noise Generation and Suppression in Aircraft Symp., Tullahoma, Tenn., 29 Jan.-2 Feb. 1968
Avail: CFSTI

The general problem of aircraft noise is examined and identified with the scientific discipline of nonlinear acoustics. Five problem areas are defined and discussed; viz., media, signal, boundary and initial conditions, governing equations, and solutions. The governing equations for wave propagation, which are identically the basic equations of fluid dynamics, are presented in an ordered form where the underlying assumptions and limitations are clearly delineated. Derivations are not included but the assumptions which permit higher order nonlinear equations to degenerate to lower order forms and ultimately to classical linear types are emphasized. A building block construction method for the various classifications of equations is presented which ultimately leads to the wave equations which are extensively used in studies of sound propagation. Author

N69-15437# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
LIGHTNING DISCHARGE HEATING OF TITANIUM AIRCRAFT SKINS
Melvin J. Kofoid Sep. 1968 65 p refs
(AD-677352; D1-82-0752) Avail: CFSTI CSCL 1/2

Because of the low thermal and electrical conductivities of titanium (Ti) metal there is serious concern as to the temperature to which skin metal may rise at the terminal of a lightning discharge to an aircraft. Of particular interest is the maximum anticipated temperature of the back side, or interior, surface when a single sheet constitutes the outer wall of a fuel tank. Author (TAB)

N69-15563 Oklahoma State Univ., Stillwater.
ANALYSIS OF SONIC BOOM WAVES INCIDENT ON STRUCTURES
Balusu Mallikarjuna Rao (Ph.D. Thesis) 1967 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8462

Mathematical methods were developed for predicting the pressure-time history of a sonic boom wave acting on an arbitrarily oriented plane wall. Three methods, ranging from highly idealized to more realistic analyses, were attempted for computing the arrival time of incident and ground reflected waves of a sonic boom acting on any given exterior wall facing the flight track. Method 2, with the assumption of linearly varying speed of sound up to the tropopause was considered to be the more exact method for standard atmospheric conditions. In the absence of atmospheric information for a given sonic boom wave, the assumption of standard atmosphere is the best available one. Method 2 was complex and required an iterative procedure for the flight altitudes above the tropopause; hence the other two methods with simplifying assumptions were developed. The applicability and the validity of the three methods were investigated for several flight altitude and Mach number ranges. Dissert. Abstr.

N69-15643# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE BIRTH OF A NEW AIRPLANE
P. Wang 9 Nov. 1967 9 p Transl. into ENGLISH from Hang K'Ung Chih Shih (Communist China), v. 3, no. 2, 1966 p 12-14
(AD-678337; FTD-HT-23-1021-67) Avail: CFSTI CSCL 1/3

The author describes the procedures taken in new aircraft development. Aerodynamic analysis, structural design, stress analysis, and wind tunnel tests constitute part of the work in aircraft design. Mockups are built for static tests and fatigue tests before the project goes into pilot production. Flight tests are required before final acceptance by the National Evaluation Committee. Author (TAB)

N69-15664*# National Aeronautics and Space Administration, Washington, D. C.
EXAMPLE OF THE USE OF A COMPUTER IN REAL TIME: CARRYING OUT STRUCTURAL TESTS OF THE CONCORDE AIRCRAFT [EXEMPLE D'EMPLOI D'UN CALCULATEUR EN TEMPS REEL: REALISATION DES ESSAIS STRUCTURAUX DE L'AVION CONCORDE]
Nov. 1968 27 p Transl. into ENGLISH from French
(NASA-TT-F-11999) Avail: CFSTI CSCL 01C

The SETI PALLAS Computer was used to direct static testing of the Concord aircraft, performing the following functions: data acquisition; channel measurement; program preparation; monitoring for error detection; off-line analysis of the tests was also performed by the same machine. The operational systems of the computer are described. Although the tests are computer controlled, human intercept is possible from the control panel at any time. A Calcomp plotting device is used for data output. Author

N69-15817# National Transportation Safety Board, Washington, D. C.
A PRELIMINARY ANALYSIS OF AIRCRAFT ACCIDENT DATA, US CIVIL AVIATION, 1967
15 Jul. 1968 27 p
(PB-179395) Avail: CFSTI CSCL 01B

The report provides a preliminary compilation and a statistical analysis of aircraft accidents in US civil aviation that occurred during calendar year 1967. Author (USGRDR)

N69-15818# National Transportation Safety Board, Washington, D. C.
BRIEFS OF ACCIDENTS, US CIVIL AVIATION ISSUE NO. 8, 1967 ACCIDENTS
1968 259 p
(PB-177340-8) Avail: CFSTI CSCL 01B

Reports of U.S. civil aircraft accidents, in brief format, including those accidents analyzed and processed during the preceding month are presented. This issue contains reports on accidents processed during the month of January, 1968. The cause factor, accident types, operational phases, and kinds of flying have been tabulated. Author (USGRDR)

N69-15932# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: TRANS WORLD AIRLINES INC. B707; N742TW, THE GREATER CINCINNATI AIRPORT, ERLANGEN, KENTUCKY, 6 NOVEMBER 1967
Sep. 1968 56 p
(PB-177399-11; SA-401) Avail: CFSTI CSCL 01B

The report contains the analysis, findings, conclusions, recommendations and corrective measures as regards to the B-707's crash while attempting to abort a take-off. Included is Mr. McAdam's (member of the National Safety Board) concurrence and dissent. USGRDR

N69-15936# National Transportation Safety Board, Washington, D. C.
AIRCRAFT ACCIDENT REPORT: PIEDMONT AVIATION, INC., PIEDMONT AIRLINES DIVISION BOEING 727, N68650 LANSEAIR INC., CESSNA 310, N3121S MIDAIR COLLISION, HENDERSONVILLE, NORTH CAROLINA, JULY 19, 1967
5 Sep. 1968 62 p refs
(PB-177339-10; SA-400) Avail: CFSTI CSCL 01B

The report covers the analysis of the fatal collision of the two aircraft in question. USGRDR

N69-15983# Centro Nazionale di Fisica dell'Atmosfera e Meteorologia, Rome (Italy).
REPORT ON AIRCRAFT CORROSION PHENOMENA [RAPPORTO SUI FENOMENI DI CORROSIONE DEI VELIVOLI]
Ottavio Vittori Antisari Consiglio Nazl. Delle Ric. Mar. 1968 39 p refs In ITALIAN Submitted for publication
(CENFAM-RDP-1) Avail: CFSTI

An analysis of general aspects of contaminated atmosphere is made with special regard to the effects of SO12B. The corrosion tests made on an aluminum sample with vapors of kerosene in an environment of sulfuric acid are also described. ESRO

N69-16085# Royal Aircraft Establishment, Farnborough (England).
INVESTIGATIONS ON THE SYSTEMATIC AND RANDOM ERRORS ARISING IN THE MEASUREMENT OF TAKE-OFF AND LANDING OF AN AIRCRAFT WITH A SINGLE KINETHEODOLITE [UNSUCHUNGEN UEBER DIE SYSTEMATISCHEN UND ZUFAELLIGEN FEHLER BEI START- UND LANDEMESSUNGEN MIT EINEM EINZELWEN KINOTHEODOLIT]
O. Weber Sep. 1968 72 p refs Transl. into ENGLISH from German Rept. DFL-67-55
(RAE-LIB-TRANS-1317; DFL-67-55) Avail: CFSTI

A survey of the fundamentals of measurements of take-off and landing of aircraft with a kinetheodolite is given, and the

systematic and random errors of the coordinates and velocity components of the observed aircraft are investigated. The survey is based on measurements with an HFB 320 jet aircraft and on kinetheodolite measurements in the laboratory. In conclusion, suggestions are made for the reduction of the more important sources of error. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-15054 Oklahoma State Univ., Stillwater.
A SYSTEM FOR THE ECONOMIC ANALYSIS OF BALANCED ENERGY CONVERSION AND STORAGE SYSTEMS
Arthur Bruckner, II (Ph.D. Thesis) 1967 231 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.00 Order No. 68-8369

A simulation system is developed to examine the economic feasibility of combined energy conversion and storage systems on the basis of annual energy demand. Annual demand is the basis for the optimization trade-off function in order to realize the full savings potential from generation plant investment as well as short term advantages in fuel economies. The objectives are the determination of storage equipment requirements so that the necessary or high potential research directions are identified in the early stages of a research and development project. Some case study indications are: no major annual effects on fuel costs; equipment cost advantages between storage procedures; probable cost advantages from over-capacity generation facilities in unconventional energy source systems. Extended storage technology research in balanced nuclear plant generation and storage systems is a recommendation. Dissert. Abstr.

N69-15171# Union Carbide Nuclear Co., Paducah, Ky.
THE PROCEDURE USED IN DISCONNECTING, REBUILDING AND CONNECTING FLUORINE CELLS
10 Apr. 1968 13 p
(Contract W-7405-ENG-26)
(KY-F-93) Avail: CFSTI

Step-by-step instructions are given on how to disconnect, dismantle, clear, repair, reassemble, and install fluorine cells. NSA

N69-15196 Purdue Univ., Lafayette, Ind.
HARMONIC ANALYSIS OF INVERTER POWERED ac MACHINES
Ronald Paul Jetton (Ph.D. Thesis) 1967 181 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-6318

By the use of a series representation of the input waveform, an analysis of the induction motor based on its equivalent circuit is carried out. The results of this approach are compared with the more cumbersome and time consuming methods of the instantaneous symmetrical component transformation used by previous workers. The results of this study indicate that for "steady-state" analysis the much simpler equivalent circuit analysis proposed here is quite adequate. The more complex methods appear to have their greatest utility in the transient case that gives rise to non-linear equations. The usefulness of the equivalent circuit, Fourier Series, approach is further illustrated by a single-phase induction motor speed control scheme proposed in this work. The basic concept is pulse width modulation applied to a variable frequency inverter. The equivalent circuit method greatly facilitates the solution of the speed-torque and current equations for this system. Dissert. Abstr.

N69-15244# Radio Corp. of America, Harrison, N. J.
SILICON GERMANIUM THERMOELECTRIC MATERIALS AND MODULE DEVELOPMENT PROGRAM Quarterly Report, 1 Apr.–30 Jun. 1968
Jun. 1968 65 p
(Contract AT(29-2)-2510)
(ALO(2510)-2; QR-2) Avail: CFSTI

The characterization and improvement of SiMo hot shoe materials and the refinement of the fabrication and bonding techniques are discussed. SiC and coated graphite were selected for evaluation as alternate hot shoe materials and hot shoes of SiC were fabricated. A Cr coating to be applied by pack cementation to tungsten cold shoes was developed. Performance of a 5-watt device comparing the effect of Dynaquartz and MIN-K 2020 fibrous insulation was observed. The successful operation of a four-couple reference design module through a typical mission environmental cycle was completed. NSA

N69-15268# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE PROBLEM OF CAVITATIONAL PHENOMENA IN HYDRAULIC SERVOMECHANISMS
G. N. Knyazev 27 Dec. 1967 8 p ref Transl. into ENGLISH from Russian
(AD-678341; FTD-HT-23-1198-67) Avail: CFSTI CSCL 13/7

V. A. Khokhlov (Avtomatika i telemekhanika, 18, No 9, 1957) investigated the stability of hydraulic executor mechanisms containing strong feedback with an inertial load acting on the piston. Using the usual assumptions, Khokhlov presented an approximate derivation of the formula for critical (from the cavitation viewpoint) mass determination for a hydraulic mechanism. The present paper offers an exact derivation of the same formula. Author (TAB)

N69-15315# Argonne National Lab., Ill. Reactor Engineering Div.
DESIGN AND TESTING OF A HIGH HEAT FLUX ELECTRON BOMBARDMENT HEATER
R. D. Carlson and R. E. Holtz Mar. 1968 33 p refs
(Contract W-31-109-ENG-38)
(ANL-7431) Avail: CFSTI

The applications of electron-bombardment heating to liquid-metal heat transfer and reactor safety experiments are discussed. Space-charge-limited heater operation with both triode and diode concepts and emission-limited heater operation are evaluated. The design of a high-heat-flux, electron-bombardment heater (EBH) is presented. The operating results of the high-heat-flux EBH are presented. Heat fluxes ranging beyond 2.5×10^6 Btu/hr-ft^2 were obtained. Long periods of EBH operation at high heat fluxes were achieved. Curves showing the operating characteristics of the high-heat-flux EBH are also presented. Author (NSA)

N69-15382*# Radio Corp. of America, Harrison, N. J.
SUPERCONDUCTIVE MAGNET SYSTEM, 14-TESLA, 15-cm-BORE
E. R. Schrader and P. A. Thompson Washington NASA Jan. 1969 55 p refs
(Contract NAS3-7101)
(NASA-CR-1260) Avail: CFSTI CSCL 09A

A description is presented of the design and construction of a 14-tesla (140-kilogauss) electromagnet with a 15-cm bore and using Nb_3Sn ribbon. A support system was developed in parallel with magnet design and construction. This system contains a standard research helium dewar and commercially available power supplies. A control console and interconnecting cables completes the entire magnet system. The magnet has four electrically separated groups of windings, the power to which can be supplied and controlled individually. This arrangement provides for a wide range

of sequential and synchronized control of the electrical modules. Such control is necessary when optimum powering of the magnet is obtained and field produced by the electromagnet is maximized. Author

N69-15388# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF THE CONSTRUCTION OF UNIVERSAL CONTACTLESS COMMUTATORS
G. P. Aksenova 28 Dec. 1967 16 p refs Transl. into ENGLISH from Russian
(AD-678424; FTD-HT-23-757-67) Avail: CFSTI CSCL 9/5

A study was made of the problems associated with setting up noncontact switching circuits made up of semiconductor elements. It is shown that the same switching circuit may be used for measuring low potentials and for switching strong signals. P16 type germanium low-power transistors should be used for setting up weak signal switching circuits. The advantages of these transistors are that they have low resistance in the open position and low residual voltage. P202 and P4 high-power transistors should be used for switching strong signals. In switching, transistors may be used successfully and find a wider application for the signal switching level above one volt. Silicon switching transistors show promise for this use. The design of transistorized switching circuits could be made easier if industry produced transistors with standardized values of the switching characteristics. TAB

N69-15397*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF SAMPLE PREPARATION ON PHOTOMICROGRAPHS OF CADMIUM SULFIDE THIN-FILM SOLAR CELLS
John M. Bozek Washington Jan. 1969 14 p
(NASA-TM-X-1722) Avail: CFSTI CSCL 10B

Cross-section photomicrographs of thin film CdS solar cells revealed large, lamellar cracks in the CdS layer. Investigation of these cracks showed that they were caused, or at least aggravated, by the mounting and polishing techniques used, particularly by the absence of firm mounting of the cell sample. Use of an aluminum mechanical sandwich or of a slab epoxy mounting technique yielded cross sectional photomicrographs of the CdS thin film solar cells showing no large, lamellar cracks in the CdS layer. Author

N69-15599*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLAR CELL RADIATION DAMAGE ON SATELLITES RELAY 1 AND RELAY 2
Ramond C. Waddel Dec. 1968 23 p refs
(NASA-TM-X-63432; X-710-68-474) Avail: CFSTI CSCL 10B

Solar cell radiation damage studies on Relay I and Relay II were designed to study, in orbit, the characteristics of several different kinds of solar cells, shielded to various degrees. The results of the experiments reported reflected the character of the spacecraft orbits; the Relay craft spent considerable time in heavily damaging regions of space. A numerical summary of the results is given in tabular form in terms of the times in orbit required for given types of cells to degrade to a given percent of their short circuit currents. Some of the conclusions drawn were: (1) The results from both Relay satellites were similar. (2) Unshielded silicon and gallium arsenide solar cells degraded to the 75% initial short circuit current response level in less than one day. (3) Shields of 19.1 mg/cm^2 extended time to 75% initial response by a factor of at least 100. (4) Silicon n/p cells with 336 mg/cm^2 shields lasted about nine times as long as similarly shielded silicon p/n cells. (5) Unshielded cells showed early damage steps associated with individual orbital passages through a highly damaging region of space; the damage steps were caused by protons whose energies were a few hundred KeV and above. B.P.

N69-15635# Royal Aircraft Establishment, Farnborough (England).
THIN SILICON SOLAR CELLS FOR LARGE FLEXIBLE ARRAYS
R. L. Crabb and F. C. Treble Nov. 1967 33 p refs Presented at the 6th Photovoltaic Specialists Conf., Cocoa Beach, Fla., Mar. 1967
(RAE-TR-67305/UL) Avail: CFSTI

Current interest in space manoeuvers with continuous thrust and an associated requirement for a lightweight multi-kilowatt, deployable solar-cell array with an overall specific mass of 20 kg kW^{-1} has led to the development of thin silicon solar cells. The performance characteristics of n on p silicon solar cells, 100 to 400 microns thick, have been evaluated following sequential irradiation by 1 MeV electron fluxes up to 10^{16} electrons cm^{-2}. Short circuit current decreases with cell thickness in good agreement with theory. An estimate of the specific mass of a flexible array demonstrates the feasibility of reducing the specific mass of state-of-the-art arrays by a factor of three and shows that the poorer initial performance of a 100 micron cell is more than offset by its smaller mass when compared with cells of conventional thickness. In addition the thinner cells are more radiation resistant. After irradiation by 10^{15} 1 MeV electrons cm^{-2} the spectral responses and consequently the air-mass-zero performances of both 100 and 400 micron cells are essentially the same. Author

N69-15680*# Naval Ammunition Depot, Crane, Ind. Quality Evaluation Lab.
EVALUATION PROGRAM FOR SECONDARY SPACECRAFT CELLS: GENERAL PERFORMANCE TEST OF GENERAL ELECTRIC 6.0 AMPERE-HOUR NICKEL CADMIUM SECONDARY SPACECRAFT CELLS
22 Nov. 1968 30 p refs
(NASA Order W-11252-B)
(NASA-CR-99121; QE/C-68-926) Avail: CFSTI CSCL 10B

The results of the general performance test of the General Electric Company 6.0 ampere-hour sealed nickel-cadmium secondary spacecraft cells, are presented. Author

N69-15686# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EV-64 HIGH-INTENSITY LIGHT PULSE SOURCE
M. I. Demidov et al 19 Dec. 1967 8 p refs Transl. into ENGLISH from Optiko-Mekhan. Prom. (USSR), no. 1, 1967 p 22-24
(AD-678328; FTD-HT-23-1291-67) Avail: CFSTI CSCL 13/1

The EV-64 high-intensity light pulse source, a new version of the EV-39, is presented. The EV-type light pulse sources are based on capillary discharge with the evaporation of walls. The EV-64 has a capillary 2 mm in diameter in a textolite plate 10 mm thick. The capillary is mounted in a discharge chamber 1000 mm long and 508 mm high. The pulses from a discharge current of 9 to 10 k amp between graphite electrodes 14 mm in diameter, fed from a battery of capacitors at a rated voltage of 5000 V, produce an output of radiative power of 82 wt at a pulse duration of 1.4 msec. The power supply circuitry, which is composed of a system of LCR circuits and primer discharge gaps, is described in detail. TAB

N69-15718*# Hughes Aircraft Co., El Segundo, Calif. Propulsion and Power Systems Lab.
STUDY ON INTEGRATION OF SILVER-ZINC BATTERY IMPROVEMENTS Interim Technical Report, 19 Jun.-31 Oct. 1968
R. A. Steinhauer 31 Oct. 1968 48 p refs
(Contract NAS5-11579)
(NASA-CR-98938; ITR-1) Avail: CFSTI CSCL 10C

The object of this program is to design a lightweight, experimental, five-cell, 12 amp-hr, silver-zinc battery for space application that incorporates many technology and design improvements for the purpose of achieving better cycle life and performance. A study was completed during this period leading to the selection of Noryl thermoplastic for the main packaging material. Further, a process evaluation of adhesive bonding, solvent joining, ultrasonic welding, and hot gas welding was made to determine which method offered the best means for producing high reliability hermetic sealing of package parts. Although many of the joining processes looked attractive at first, adhesive bonding was selected. The battery design developed during this reporting period offers the best tradeoff for lightweight, reliable performance, and the ability to integrate the desired technology improvements. The following list outlines the salient features of the battery to be built during the next reporting period. Author

N69-15758# Eidgenoessische Technische Hochschule, Zurich (Switzerland).

MATERIAL TRANSPORT AND OPTIMIZATION OF ELECTRODES AWASH IN A STREAM OF GAS BUBBLES [ZUR KENNTNIS DES STOFFTRANSPORTES AN GASBLASENBESPUELTEN ELEKTRODEN UND DEREN OPTIMIERUNG]

Eric Peter Adam (Ph.D. Thesis) 1967 112 p refs In GERMAN /ts Dissertation No. 4047

Avail: CFSTI

The optimization of the stirring by gas bubbles of electrolytic cells was studied experimentally and theoretically. The experimental determination of material transport was of special interest because of the low costs of this type of stirring and because knowledge of the material transport correlation is scant. The speed of the material transport process was determined electrochemically by measuring the limiting current of a redox system. A sandwich cell of industrial dimensions was used which was constructed to be polyvalent, with polymethyl methacrylate for the structure and nickel for the electrodes. Ferric potassium /potassium ferrocyanide in 2N sodium solution was used as the redox electrolyte. Speed of material transport was measured at total and partial stirring as a function of electrode height, gas flow, gas bubble size, and electrode interval. The results of the gas stirring are compared with those obtained by other methods. Transl. by K.W.

N69-15760*# American Univ., Washington, D. C.

RESEARCH INTO FUNDAMENTAL PHENOMENA ASSOCIATED WITH SPACECRAFT ELECTROCHEMICAL DEVICES, CALORIMETRY OF NICKEL-CADMIUM CELLS Progress Report, 1 Apr.-30 Jun. 1968

R. T. Foley and G. D. Mitchell 30 Jun. 1968 32 p refs

(Contract NAS5-10105)

(NASA-CR-99156; PR-8) Avail: CFSTI CSCL 10C

The work described is subdivided into four experimental sections. The first section involves the study of the thermal characteristics of the calorimeter. This considers the effect of flow rate and thermopile positioning on the thermal response of the system. The second section involves the evaluation of the thermal output of a 20 ampere-hour nickel-cadmium cell under conditions of 15% depth of discharge and 105% charge rate at 25°C. In the third section a study of the thermal output of a 20 ampere-hour cell is made under the rundown conditions of 25% depth of discharge and 100% recharge rate at 25°C. The fourth section is the evaluation of the effect of the Adhydrode on the apparent enthalpy (ΔH), the cell pressure, and the thermal output of the cell at 25°C. Author

N69-15799# Bureau of Mines, Morgantown, W. Va. Coal Research Center.

COMPUTER USAGE FOR EVALUATION OF DESIGN PARAMETERS AND COST OF HEAT EXCHANGERS: WITH NO CHANGE IN PHASE AND TUBE SIDE PUMPING COSTS AS PRIME PARAMETERS

Paul R. Jones and S. Katell Jan. 1969 72 p refs

(BM-IC-8399) Avail: CFSTI

A computer program was written for design and cost of a shell and tube heat exchanger in which the total cost, which includes annual fixed charges and annual operating costs, was minimized. The program was written for the type of heat exchanger in which only the tube side pumping costs were significant and for triangular pitch, single or multiple pass, heating or cooling, and no change in phase. Tube diameter was not optimized since the tube dimensions do not affect the cost very much. However, the tube dimensions do affect the shell diameter, number of tubes, and length of tubes; and price optimum design was obtained for four standard tube diameters. Standard heat exchangers having at least the required area are also listed. The program was made adaptable to various fluids and to various tube dimensions by including many of the required data such as physical properties of the fluids, tube data, and standard shell data as input data. Author

N69-15801*# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.

SOLAR CELL CONTACT DEVELOPMENT Quarterly Report, 28 Jun.-28 Sep. 1968

28 Sep. 1968 56 p refs

(Contract NAS5-11595)

(NASA-CR-99160; QR-1) Avail: CFSTI CSCL 10B

Degraded and non-degraded Si solar cells were subjects of a characterization study that employed a number of analytical tools. Optical examination of the interface exposed by a peeled contact almost without exception shows pronounced interference colors as observed under white light. X-ray examination of Ti-Ag contacts reveals the presence of well-crystallized Ag. Electron microprobe analysis clearly demonstrates that Ti and also some Ag remain on the Si solar cell subsequent to peeling. EMM observations on as-received, peeled, and sectioned cells reveal some evidence of a dielectric charging behavior. Charging appeared to be most pronounced on one non-peeled cell while less charging is noted in peeled cells. Auger spectra have been recorded from the Ti-Ag contact pad subsequent to a number of sputter-stripping treatments. Auger peaks from Ag have been readily noted in Auger spectra in addition to a peak at 90 eV (Si) and at 183 eV. We conclude that the contact peeling problem originates within the Ti-Ag metallized contact and more than likely near the Ti-Ag interfacial region, if not within the Ti layer itself. Author

N69-15810*# Electric Storage Battery Co., Yardley, Pa. Research Center.

ALKALINE BATTERY SEPARATOR CHARACTERIZATION STUDIES Quarterly Report, 23 Mar.-23 Jun. 1968

J. J. Kelley and J. Szymborski 23 Jun. 1968 25 p refs

(Contract NAS5-10418)

(NASA-CR-99194; QR-4) Avail: CFSTI CSCL 10C

During the period, cell testing of the candidate membranes was completed. Seventeen membrane type separators and eight of the absorber variety were tested. Completed results are reported on twelve membranes and all absorbers. Three membrane separators have been chosen on the basis of screening test data for testing in 12-ampere hour batteries. These are Permions 1770C and 2290, and Borden 574-151F. Cell performance of $Ca(OH)_2$ coated positive electrodes was encouraging in that although the cycle life obtained was short of the specified goal, failure in each cell was localized at the coating edges. Results are not, as yet, completed on those separators which required modification of the cell construction to obtain reliable data on cell performance. Author

N69-15892# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
SOLAR CELL DEGRADATION AND THE SOLAR CELL SHIELD
M. Bazzani Paris ESRO Mar. 1967 37 p
(ESRO-TM-P-97-ESTEC) Avail: CFSTI

An attempt has been made in this report to determine the minimum thickness of the shield necessary to contain solar cell degradation within desired limits when subjected to space radiation, so that certain required power is available at the end of the lifetime of a spacecraft. A comparison is made between the different weights of the solar array for the three solutions proposed. ESRO

N69-15894# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
POWER SUPPLIES FOR THE SINGLE AXIS SIMULATOR
J. G. Fielding Paris ESRO Dec. 1966 20 p ref
(ESRO-TM-P-82(ESTEC)) Avail: CFSTI

A description is given of the design of the main power supplies for the single axis simulator, using a battery powered system and silver cadmium cells similar to the system required for a three axis simulator, following in principle satellite power supply techniques. ESRO

N69-15909*# American Univ., Washington, D. C.
RESEARCH INTO FUNDAMENTAL PHENOMENA ASSOCIATED WITH SPACECRAFT ELECTROCHEMICAL DEVICES, CALORIMETRY OF NICKEL-CADMIUM CELLS Progress Report, 1 Jan.-31 Mar. 1968
R. T. Foley, G. D. Mitchell, and G. N. Roberts 31 Mar. 1968 27 p refs
(Contract NAS5-10105)
(NASA-CR-99196; PR-7) Avail: CFSTI CSCL 10C

The work completed during this period is divided into three tasks: the cycling of a 20 ampere-hour Ni-Cd cell, a charge conditioning and overcharge experiment, and a trickle charge experiment. The maximum exothermic output exhibited during the cycling of the 20 ampere-hour Ni-Cd cell (30 minutes discharge at 25% depth and 60 minutes charge at 110% recharge rate) was 1.3 watts. During the charge conditioning and overcharge experiment the cell was charged for a 30 hour period at c/10 or 2 amperes. The heat, pressure, and enthalpy all reached a steady state after about 20 hours. The trickle charge experiment was conducted with currents ranging from 2 to 0.14 amp. The ratio of heat energy out to electrical energy in during this set of experiments, ranged from 60% to 132%, increasing with decreasing charging current. Author

N69-15928# Oak Ridge National Lab., Tenn.
FLUX PUMPS AS POWER SUPPLIES IN COMPARISON WITH ALTERNATIVES
M. S. Lubell and K. R. Efferson 29 Aug. 1968 13 p refs Submitted for publication Sponsored by AEC
(Contract W-7405-ENG-26)
(ORNL-TM-2351) Avail: CFSTI

Losses associated with energizing a superconducting magnet were studied by comparing the losses for various modes of operation of a flux pump and vapor-cooled input leads. Losses of vapor-cooled leads surpass flux pump losses. Flux pumps are found to be more efficient. To reduce losses in operating large magnets where rotating magnet flux pumps are unsuitable, vapor-cooled leads are used to energize the magnet. After maximum current is reached, the system is placed in persistent mode with a superconducting short. To reduce heat leaks, the current contact can be opened. It may also be necessary to employ a flux coil detection system which can be used to remotely control a motor to reconnect the vapor-cooled leads when needed. NSA

N69-15947# Communication Satellite Corp., Washington, D. C.
SOLAR CELLS AT SYNCHRONOUS ALTITUDE Summary Report
Denis J. Curtin 15 Mar. 1968 18 p refs Symp. held at Washington, 15 Mar. 1968
(CL-11-68; PB-179650) Avail: CFSTI CSCL 10B

This report contains the findings obtained during a symposium relative to radiation environment of solar cells at synchronous altitude, radiation damage to solar cells, satellite flight results, and possible remedies for solar cell degradation. USGRDR

N69-15960*# American Univ., Washington, D. C.
RESEARCH INTO FUNDAMENTAL PHENOMENA ASSOCIATED WITH SPACECRAFT ELECTROCHEMICAL DEVICES, CALORIMETRY OF NICKEL-CADMIUM CELLS Progress Report, 1 Oct.-31 Dec. 1967
R. T. Foley, G. D. Mitchell, and G. N. Roberts 31 Dec. 1967 21 p refs
(Contract NAS5-10105)
(NASA-CR-99197; PR-6) Avail: CFSTI CSCL 10C

The objectives are to train electrochemists in the area of battery research and to collect electrochemical and thermodynamic data. Most of the current laboratory work consisted of improvements and modifications to the experimental apparatus, including electrical modifications to the supporting electronic components, and mechanical modifications to the calorimeter itself. A literature search was conducted in order to: 1) Obtain the best recorded values for the heats of formation of the species involved in the proposed charge reaction so that the best calculation of the enthalpy change could be made; and 2) Complete a bibliography on the thermochemistry of nickel-cadmium cells. Also presented is a discussion of the enthalpy change for the cell reaction from the thermodynamic viewpoint. Author

N69-15961*# General Electric Co., Gainesville, Fla. Battery Business Section.
OPTIMIZATION OF DESIGN PARAMETERS FOR SPACECRAFT NICKEL-CADMIUM CELLS CONTAINING RECOMBINATION AND CONTROL ELECTRODES Quarterly Report
I. B. Weinstock and G. Rampel Oct. 1968 23 p ref
(Contract NAS5-11547)
(NASA-CR-99195; QR-1) Avail: CFSTI CSCL 10C

Plans for an investigation of the factors which contribute to the cycle capability of cells built with oxygen recombination and oxygen sensing control electrodes are presented. The purpose of this program is to optimize the design parameters for such cells and extend their usefulness for spacecraft applications. Included is a description of the cells and equipment to be used, as well as the detailed test plans. Preliminary cell performance characteristics are also reported. Author

N69-16077# Communication Satellite Corp., Washington, D. C.
ADHYDRODE CONTROL OF Ni-Cd BATTERY CHARGING TO EVALUATE CHARGING METHODS
James D. Dunlop and R. W. Bounds 1 Jul. 1968 21 p refs
(PB-179649; CL-13-68) Avail: CFSTI CSCL 10C

In addition to its normal application of controlling overcharge, the adhydrode was used to compare pulse charging with constant current charging methods. A charge control circuit utilizing a differential comparator integrated circuit was developed. Results were that pulse charging offers no significant advantages. However, the adhydrode charge control provides a reliable means for

minimizing overcharge, extending cycle life at deep depths of discharge. For satellite application the potential advantage is to increase usable energy density. Author (USGRDR)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N69-15032# Cornell Univ., Ithaca, N. Y.
[PHOTOSYNTHETIC ENERGY CONVERSION] Annual Progress Report, Sep. 1–Aug. 31, 1968
Roderick K. Clayton Aug. 1968 10 p refs
(Contract AT(30-1)-3759)
(NYO-3759-5) Avail: CFSTI

The photosynthetic bacterium, *Rhodopseudomonas spheroides*, was used for studies on isolation and characterization of photochemical reaction centers. Light-induced absorption difference spectra of reaction centers showed reversible effects. Architecture of reaction centers was determined from the polarization of P870 fluorescence. Fluorescence of reaction centers was studied in relation to their photochemical activity. The high concentration of photoreactive material in the reaction centers allows measurement of the photosynthetic electron spin resonance signal with unusually high signal to noise ratio and affords an accurate correlation with the photochemical events inferred from optical absorbance measurements. Kinetics and thermodynamics of excitation transfer among light harvesting pigments of photosynthetic bacteria were studied. Delayed fluorescence and chemiluminescence in photosynthetic tissues of spinach chloroplasts were studied. NSA

N69-15038# Little (Arthur D.), Inc., Cambridge, Mass.
MACROMOLECULE HYDRATION AND THE EFFECTS OF SOLUTES ON THE CLOUD POINT OF AQUEOUS SOLUTIONS OF POLYVINYL METHYL ETHER: A POSSIBLE MODEL FOR PROTEIN DENATURATION AND TEMPERATURE CONTROL IN HOMEOTHERMIC ANIMALS
R. H. Horne, J. P. Almeida, A. F. Day, and N.-T. Yu 30 Aug. 1968 43 p refs
(Contract Nonr-4424(00))
(AD-674115; TR-36) Avail:CFSTI CSCL 6/1

The effect of strong, neutral, 1:1 electrolytes; MGSO4; area, tetraalkylammonium salts, succrose and alcohols in the cloud point temperature of aqueous solutions of polyvinyl methyl ether have been examined and are interpreted in terms of (1) the two types of water structure, coulombic and hydrophobic, comprising the hydration sheath of polymer, (2) the selective exclusion of solute from the polymer's hydration sheath, and (3) the solute's stabilization or destabilization of the polymer's hydration sheath. The last two of these processes are related to the viscosity B-coefficient of the solute ions. The behavior of the polymer exhibits both similarities to and differences from proteins, and caution must be exercised in the use of the cloud point phenomenon as a model of protein denaturation. The solute effects suggest a possible experimental test of the hypothesis that the thermal destruction of a biopolymer's hydration sheath might provide the basis of temperature control in homeothermic animals. Author (TAB)

N69-15087# Federal Aviation Agency, Washington, D. C.
CIRCADIAN RHYTHMS: SELECTED REFERENCES
Louise Annus Heller Jul. 1968 86 p refs *Its* Bibliographic List No. 15
(AD-674882) Avail: CFSTI CSCL 6/16

Contents: Ecological Factors; Psychological Factors; Physiological Factors—Body Chemistry, Respiration, Alimentation, Heart-Rate, Temperature and other Somatic Responses; Worc-Rest Cycle, Long Distance Flights; Medical Aspects; Animal and Plant Studies. Author (TAB)

N69-15101 California Univ., Los Angeles.
BIOTELEMETRY APPLIED TO THE MEASUREMENT OF BLOOD PRESSURE
Leslie Cromwell (Ph.D. Thesis) 1961 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-7458

The approach was to apply the ideas of an engineering systems design to biological phenomenon. This involved the consideration of many sub-systems, and then integrating these into a complete system to continuously monitor blood pressure. The sub-systems involved: A method of sensing blood pressure and heart rate, amplifying the data and transmitting it; a method of receiving the data by a radio link; methods of displaying and recording the data; and methods of interpreting and processing the data. Each of these were designed to comply with high bio-metrical standards. The dog itself was considered as a sub-system, and the engineering of methods of implantation inside the aorta, and means of protection for the dog and equipment are an integral part of the study. Dissert. Abstr.

N69-15210# Naval Medical Research Inst., Bethesda, Md.
BIOCHEMICAL APPROACH TO STRESS PROBLEMS
Julius Sendroy, Jr. 18 Sep. 1968 21 p Presented at the Ann. Meeting of the Am. Assoc. of Clin. Chemists, Washington, 22 Aug. 1968
(AD-677278; Rept-18) Avail:CFSTI CSCL 6/19

Consideration is given to the meaning of, and variation in, stress and an attempt is made to arrive at an acceptable biomedical definition of stress. Attention is called to the mission, activities and responsibilities of the Bureau of Medicine and Surgery of the Department of the Navy, and emphasis is laid on the fact that most of these have to do with the physical and mental health of personnel under quite stressful conditions of environmental and/or operational origin. Many physical, physiological and psychological stresses are encountered in Navy and/or military service and give rise to unique problems which are the subjects or research in the Navy's Biomedical Laboratories. Responses to stress, regulated by physiological systems, may be studied as biochemical manifestations of the organism's reaction to changes in internal and external environment. In the consideration of disease as a form of stress, the role of the clinical chemist should be viewed as that of a biochemist rather than of a specialist isolated in the clinical laboratory. Author (TAB)

N69-15225# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France). Centre d'Etudes Nucleaires.
RELATIVE BIOLOGICAL EFFICIENCY OF 592 MeV PROTONS. ANALYSIS OF THE BIOLOGICAL EFFECT OF SECONDARY RADIATION [EFFICACITE BIOLOGIQUE RELATIVE DES PROTONS DE 592 MeV. ANALYSE DE L'EFFET BIOLOGIQUE DU AUX RAYONNEMENTS SECONDAIRES]
Gerard Legeay and Johan Baarli (European Organ. for Nucl. Res.) Jun. 1968 29 p refs In FRENCH
(CEA-R-3447) Avail: CFSTI

The relative biological efficiency (RBE) of high energy protons is of importance because of their effects in the field of radio-protection around large accelerators and during space-flights. The nature of the interactions between 592 MeV protons and biological tissues makes it necessary to take into consideration the contribution of secondary radiation to the biological effect. Since it is not possible to obtain from a synchrotron a beam having a

sufficiently large cross-section to irradiate large animals, one has to resort to certain devices concerning the mode of exposure when small laboratory animals are used. By irradiating rats individually and in groups, and by using the lethal test as a function of time, the authors show that the value of the RBE is different for animals of the same species having the same biological parameters. Thus there appears an increase in the biological effect due to secondary radiation produced in nuclear cascades which develop in a large volume, for example that of a human being. Author (NSA)

N69-15227*# Baylor Univ., Houston, Tex. Psychophysiology Lab.
HEART RATE RESPONSE TO SOUND AND LIGHT
Robert Roessler, Forrest Collins, and Neil R. Burch [1967] 30 p refs
(Grants NGR-44-003-031; AF-AFOSR-727-65; NIH G-MH-13630; PHS-G-FR-00254)
(NASA-CR-98918; AD-677608; AFOSR-68-2167) Avail: CFSTI CSCL 05J

The heart rate (hr) response to five intensities of sound was examined in 18 subjects and to five intensities of light in 12 subjects. Each subject was tested on four occasions at monthly intervals. After covariance adjustment, significant acceleration to sound was found within the first 5 beats after stimulus onset but no significant deceleration occurred. There were no differences between testings. Individuals' hr acceleration was reliable over testings and differing experimental contexts. No habituation occurred and no consistent relationship between HR response and ago strength was found. There was no significant HR response to light stimulation. The results were discussed in relation to Graham and Clifton's (1966) hypotheses concerning the relationship of the HR response to the orienting reflex (OR). Author (TAB)

N69-15277# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
FRACTIONATION OF SUSPENDED AND COLLOIDAL PARTICLES IN NATURAL WATER
William T. Lammers 10 Oct. 1968 42 p refs
(Contract W-7405-ENG-26)
(K-1749) Avail: CFSTI

Feasibility studies were conducted in the Biophysical Limnology Laboratory on the use of centrifugal techniques for isolating insoluble materials from samples of natural water. The isolated particulate fractions were then used in studies encompassing several areas of water pollution with particular emphasis on the characterization of different groups of isolated particles. These characterizations were confined to the physical, chemical, and biological properties of suspended and colloidal particles which influence their separation, concentration, and analysis. Systems and techniques were developed for separating these materials into relatively pure particulate groups and for making reliable analytical determinations. A discussion of particle characterization methods and the instruments, techniques, and calculations used in isolating the different particulate groups for study are presented. Author (NSA)

N69-16286 California Univ., Berkeley.
A TREATISE IN ORGANIC GEOCHEMISTRY
Eugene Desmond McCarthy (Ph.D. Thesis) 1967 312 p
Avail: Univ. Microfilms: HC $14.20/Microfilm $4.00 Order No. 68-5780

This treatise has concerned itself with a study of the major problems in organic geochemistry and how they relate to the more fundamental scientific questions of chemical evolution and the origin of life. The significant advances in organic geochemistry, which have been brought about within the last fifteen years, have been achieved as a result of development of analytical techniques capable of handling microgram quantities of organic material—in particular, gas-liquid chromatography and mass spectrometry. Almost all of the analytical techniques of modern organic chemistry have been utilized in the structural identification of the organic components isolated from a series of crude oils and sediments. Since the major part of the work has concentrated on the hydrocarbons, there has been a particular emphasis on capillary gas chromatography and mass spectrometry. Dissert. Abstr.

N69-15324# Rochester Univ., N. Y. Dept. of Radiation Biology and Biophysics.
CHARGE ON LATEX PARTICLES AEROSOLIZED FROM SUSPENSIONS AND THEIR NEUTRALIZATION IN A TRITIUM DE-IONIZER
An-Liang Soong (M.S. Thesis) 30 Sep. 1968 52 p refs
(Contract W-7401-ENG-49)
(UR-49-1000) Avail: CFSTI

The charge distribution on insoluble particles produced by atomization of a suspension was measured. The degree to which the charges have been neutralized by passage through a tritium deionizer was determined. NSA

N69-15332# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
EXDOSE: A COMPUTER PROGRAM FOR CALCULATING THE EXTERNAL GAMMA DOSE FROM AIRBORNE FISSION PRODUCTS
M. M. Hendrickson Sep. 1968 124 p refs
(Contract AT(45-1)-1830)
(BNWL-811) Avail: CFSTI

The EXDOSE program calculates the external γ radiation dose to the whole-body of man from a half-infinite cloud of fission products. It is designed primarily for estimating accident consequences. The code calculates a fission product inventory according to specified input parameters. Any fraction of these fission products may then be released to the atmosphere at a desired rate. The subsequent downwind dispersion and resulting dose to individuals is then calculated. Author (NSA)

N69-15347*# National Aeronautics and Space Administration, Washington, D. C.
THE EFFECT OF ENVIRONMENT ON THE GROWTH OF TADPOLES [UEBER DEN EINFLUSS DES LEBENSRAUMES AUF DAS WACHSTUM DER KAULQUAPPEN]
F. Bilski Dec. 1968 17 p refs Transl. into ENGLISH from Arch. Ges. Physiol. (Berlin), v. 188, 1921 p 254-272
(NASA-TT-F-11947) Avail: CFSTI CSCL 06F

The manner in which growth is influenced by the available living space is investigated using Bufo tadpoles as subjects. Weight increase was the criterion of growth. The author finds a direct relationship between the number of tadpoles, the size of the breeding vessel, and the weight that the animals reach. Author

N69-15349*# Technan Corp., Glen Burnie, Md.
BIOCHEMICAL STUDIES ON PROTEINOID (POLYANHYDRO-α-AMINO ACIDS) [BIOCHEMISCHE UNTERSUCHUNGEN AN PROTEINOIDEN (POLYANHYDRO-α-AMINOSAUREN)]
G. Krampitz et al Washington NASA Jan. 1969 14 p refs Transl. into ENGLISH from German Rept. BMwF-FBW-68-30
(Contract NASw-1695)
(NASA-TT-F-12090) Avail: CFSTI CSCL 06A

At 1000°C all amino acids present in biological proteins are formed from methane, ammonia, and water vapor. Heating of all 18 amino acids to 170 to 180°C leads to polypeptides. Molecular weight, properties of proteinoids, formation of morphological structures, and reproducibility of results are discussed. Amino acids do not assume random distribution in combination with peptides. Use as nutrient. Radioactivity distribution and structure of proteinoids are presented graphically. Author

N69-15350*# Techtran Corp., Glen Burnie, Md.
THE HISTOCHEMISTRY OF CERTAIN ENERGY-EXCHANGE ENZYMES IN THE INDUCED FORMATION OF SILICOTIC CONNECTIVE TISSUE [GISTOKHIMIYA NEKOTORYKH FERMENTOV ENERGETICHESKOGO OBMENA V PROTSESSE EKSPERIMENTAL'NOGO OBRAZOVANIYA SILIKOTICHESKOY SOYEDINITEL'NOY TKANI]
I. M. Shnaydman Washington NASA Jan. 1969 10 p refs Transl. into ENGLISH from Arkh. Patol. (Moscow), v. 27, 1965 p 34-41
(Contract NASw-1695)
(NASA-TT-F-12088) Avail: CFSTI CSCL 06A

During the early stages of development of silicosis (1 to 3 weeks following endotrachial administration of quartz dust), high activity of oxidation-reduction enzymes in the connective tissue cells of the forming silicotic nodules was noted. The activity was most marked in the case of NPN-N-nitrotetrazolium blue reductase and the nitrotetrazolium blue reductases (of lactic acid, α-glycerophosphate and malic acid), and also in the case of cytochrome oxidase. Less activity was noted in the case of the nitrotetrazolium blue reductases (of isocitric and succinic acid); and least activity in the case of nitrotetrazolium blue the reductases of glucose-6-phosphate and TPN-N-nitrotetrazolium blue. With the development of silicotic nodules, activity of the oxidation-reduction enzymes in silicotic connective tissue fell off progressively, and disappeared in most nodules during the period from three and one half to 5 months following the experiments. Author

N69-15351*# Techtran Corp., Glen Burnie, Md.
PHYSIOLOGICAL REACTIONS AND POSSIBLE MEANS OF PROTECTION DURING LONG TERM EXPOSURE TO WEIGHTLESS CONDITIONS [FIZIOLOGICHESKIYE REAKTSII I VOZMOZHNIYE SREDSTVA ZASHCHITY PRI DLITEL'NOM PREBYVANII V USLOVIYAKH NEVESOMOSTI]
B. B. Yegorov Washington NASA Jan. 1969 7 p Transl. into ENGLISH from Russian Presented at the 3d Intern. Symp. on the Basic Environ. Probl. of Man in Space, Geneva, 15-19 Nov. 1968
(Contract NASw-1695)
(NASA-TT-F-12095) Avail: CFSTI CSCL 06S

The results of investigations are given dealing with the possibilities of normalizing certain physiological processes that change during weightlessness, thus decreasing the body tolerances to accelerations. The data presented cover the application of muscle bioelectro-stimulation to normalize afferent impulses, to increase the energy load of the muscular tissue and to develop "the physiological anti-acceleration suit". In the experiments the mineral metabolism was stabilized with the aid of alternating gradient hypoxia. It is suggested that hyperoxic and hypercapnic gas mixtures be used as a method of increasing the body tolerance to accelerations. Author

N69-15448# European Organization for Nuclear Research, Geneva (Switzerland).
RADIONUCLIDES INDUCED IN BONE BY 600 MeV PROTONS
Antonio Pasinetti and Felix Hoffmann Apr. 1968 64 p refs Supported in part by Natl. Res. Council of Italy
(CERN/HER/AP-2-68) Avail: CFSTI

Experimental data concerning radioisotopes induced in bone by 600 MeV protons are presented. Tables giving the dose, flux of irradiating particles, induced activation, disintegration rate, irradiation time, and energy of incident particles are given for the isotopes ^{7}Be, ^{11}C, ^{22}Na, and ^{24}Na. One series of tables includes data resulting from constant time of irradiation; another series includes data resulting from irradiation with constant flux of particles. The radioisotopes found in bone from γ counts after irradiation with high-energy protons were ^{7}Be, ^{11}C, ^{18}F, ^{28}Mg, ^{13}N, ^{22}Na, ^{24}Na, and ^{31}S; those found from β counts were ^{11}C, ^{18}F, ^{43}K, ^{28}Mg, ^{13}N, ^{24}Na, ^{32}P, ^{32}P, ^{38}S, and ^{31}Si. Tables are presented on the chemical composition of bone in standard man and on cross-sections for protons with kinetic energy of 600 MeV. NSA

N69-15528# Joint Publications Research Service, Washington, D. C.
USSR NATIONAL RADIATION AND ORGANISM CONFERENCE
G. Khadzhidekov 6 Jan. 1969 7 p Transl. into ENGLISH from Rentgenol. Radiol. (Sofia), Apr. 1968 p 204-206
(JPRS-47186) Avail: CFSTI

A summary review of the radiation and organism conference held in the U.S.S.R. is presented. A total of 127 papers were presented in two sections, the experimental and clinical. The papers presented in the experimental section were on the following problems: (1) total radioactivity of the organism and its surrounding environment; (2) reaction of the organism to the action of ionizing radiations; (3) radiosensitivity and radioresistance; (4) radiation genetics; and (5) the problem of postradiation effect. Papers in the clinical section were grouped around the following: new methods of roentgen diagnosis; computer diagnosis and automation in medicine and biology; radioisotopic diagnosis and radiation load; urgent problems in scanning; and problems in radiation therapy. B.P.

N69-15550# Pisa Univ. (Italy). Istituto di Fisiologia.
COMPARATIVE NEUROPHYSIOLOGY OF THE VISUAL SYSTEM Final Scientific Report, 15 Sep. 1967-14 Sep. 1968
Giuseppe Moruzzi 14 Sep. 1968 19 p refs
(Contract F61052-68-C-0024)
(AD-677305; AFOSR-68-2317) Avail: CFSTI CSCL 6/3

The following themes have been investigated under the research on Comparative Neurophysiology of the Visual System: (1) Peripheral inhibition of flashing in fireflies (Brunelli, Buonamici and Magni, in part with the collaboration of Viola, Istituto di Patologia Generale, University of Pisa). (2) Modulation of the retinal dark discharge from the pigeon eyes (Brunelli, Buonamici and Magni). (3) Spatial interaction in the visual system (Cervetto and Maffei; Fiorentini and Maffei; Maffei). (4) Sympathetic influences on the retinal dark discharge (Berlucchi, Marzi and Mascetti). (5) Visuo-cortical lesions and interhemispheric transfer of visual information (Berlucchi and Mascetti). (6) Role of visual cortex and midbrain in visual learning and memory (Berlucchi and Sprague; in collaboration with the Department of Anatomy of the University of Pennsylvania). Author (TAB)

N69-15595# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MECHANISM OF THE EFFECT OF BERYLLIUM ON THE ORGANISM
O. G. Alekseyeva et al 3 Jan. 1968 7 p refs Transl. into ENGLISH from Farmakol. i Toksikol. (Moscow), no. 3, 1966 p 353-355
(AD-676338; FTD-HT-23-1163-67) Avail: CFSTI CSCL 6/20

The mechanism of the effect of beryllium on the organism is summed up as follows: (1) Even in a complex with homologous protein beryllium (chloride, sulfate or oxide) does not evoke the formation of humoral antibodies or allergy of the anaphylactic shock type. (2) Subcutaneous injection of soluble beryllium salts leads to the development of an inflammatory reaction after 1-2 days; repeated injections can amplify its manifestation. The complex of beryllium plus protein has less expressed primary toxic effect than beryllium alone. Author (TAB)

N69-15596*# Techtran Corp., Glen Burnie, Md.
SOME COMPENSATION REACTIONS DURING EXTENDED WEIGHTLESSNESS [NEKOTORYYE KOMPENSATSIONNYYE REAKTSII V DLITEL'NOM SOSTOYANII NEVESOMOSTI]
Yu. Valyavski Washington NASA Jan. 1969 8 p Transl. into ENGLISH from Russian Presented at the 3d Intern. Symp. on the Basic Environ. Probl. of Man in Space, Geneva, 15–19 Nov. 1968
(Contract NASw-1695)
(NASA-TT-F-12094) Avail: CFSTI CSCL 06S

The compensatory reactions arising in the human body in response to extended weightlessness are listed. Circulatory, hemodynamic, immunological, metabolic, nervous, and emotional reactions are discussed. It is pointed out that the reactions to weightlessness are difficult to distinguish from the accompanying reactions to hypokinesia and the emotional factors. Author

N69-15615# Joint Publications Research Service, Washington, D. C.
WATER-SALT METABOLISM DURING SPACEFLIGHT [VODNO-SOLEVOY OBMEN PRI KOSMICHESKIKH POLETAKH]
I. S. Balakhovskiy 21 Nov. 1968 19 p refs Transl. into ENGLISH from Russian Presented at the 19th Congr. of the Intern. Aeron. Federation, Oct. 1968
(JPRS-46926) Avail: CFSTI

Weight loss by astronauts during space flight is discussed in relation to water-salt metabolism. Weight loss statistics of both Soviet and American astronauts are presented, as well as physiological data from blood and urine analysis. It is shown that weight losses indicated in these statistics can be chiefly attributed to elimination of water. Author

N69-15690*# Naval Aerospace Medical Inst., Pensacola, Fla.
RAPID VESTIBULAR ADAPTATION IN A ROTATING ENVIRONMENT BY MEANS OF CONTROLLED HEAD MOVEMENTS
Ashton Graybiel and Charles D. Wood 9 Dec. 1968 18 p refs
(NASA Order R-93; Proj. MR005.04-0021.159)
(NASA-CR-99043; NAMI-1053) Avail: CFSTI CSCL 06S

Two attempts to telescope, in time, vestibular adaptation in a slow rotation room (SRR) were made to determine the easiest and quickest means of preventing the appearance of SRR sickness at a terminal velocity of 10 rpm. Three subjects in each experiment were exposed to unit increases in rotational velocity at which time they made several hundred experimenter-directed head movements. Prior to cessation of rotation standardized tasks were performed to determine the degree of transfer of adaptation acquired from the "directed" movements. The results demonstrate that the process of homeostatic adaptation can be greatly speeded up through experimental control of head movements although a large number of "limited" head motions must be made to ensure transfer of adaptation to general activities. Some idea was gained regarding the number and excursion of head movements required at each unit increase in rpm for adaptation and overadaptation at terminal velocity. Author

N69-15782*# California Univ., Los Angeles. Space Biology Lab.
SUMMER INSTITUTE IN SPACE BIOLOGY Final Report, Apr. 1–Nov. 30, 1968
J. D. French and W. R. Adey 30 Nov. 1968 168 p refs
(Contract NSR-05-007-089)
(NASA-CR-99076) Avail: CFSTI CSCL 06C

The Space Biology Laboratory conducted its third Summer Institute in Space Biology during 1968. The five week program of lectures, discussions and field trips was for selected undergraduate students with backgrounds in life and physical sciences. The Institute included lectures by teaching and research faculty from the University of Southern California and Harbor General Hospital, as well as from the UCLA School of Medicine, and the Life Sciences Division and Biosatellite group at Ames Research Center. The curriculum provided a survey of physiological functions liable to modification in the space environment, including effects of weightlessness on cardiovascular and renal reflexes and on body fluid distribution; the effects of confinement on metabolic functions; and modifications of cyclic mechanisms in sleep, body temperature control and endocrine functions. Central nervous functions were discussed in relation to the stresses of acceleration and vibration, effects of weightlessness on visual and vestibular components of motor performance, and the possible effects of the space environment on psychic functions. Lectures were supplemented by trips to Ames Research Center, the Space Cabin Simulator at Douglas, and the Navy's Sealab 3 Project. Details on participating students, faculty, curriculum, syllabus, and special reports are included. A.L.

N69-15792# Joint Publications Research Service, Washington, D. C.
CONTROL PROCESSES IN THE RESPIRATORY SYSTEM
N. V. Zavalishen et al *In its* Adjustment of Adaptive Systems Invest. 23 Dec. 1968 p 17–37 refs (See N69-15790 05-10)
Avail: CFSTI

The results of experimental checking of two alternate hypotheses recording the control of the respiratory parameters of living organisms are presented. It is shown that the observed experimental facts can only be explained from the point of view of the functional control hypothesis. Author

N69-15797# Avco-Everett Research Lab., Everett, Mass.
AN EXPERIMENTAL PREPARATION FOR THE STUDY OF THROMBOSIS ON ARTIFICAL SURFACES UNDER CONTROLLED FLOW CONDITIONS
H. E. Petschek, D. Adamis, and Arthur Kantrowitz Sep. 1968 70 p refs
(Contract PH-43-67-1120)
(Avco-Everett Res. Rept-314) Avail: Issuing Activity

An experimental preparation has been developed in which thrombus formation on artificial surfaces can be observed over a range of controlled blood flow conditions. Virgin blood, i.e., blood with no previous surface contact or activation, forms a stagnation point flow on the underside of a microscope cover slip. Direct observation of individual platelet settling, the existence of fibers, and the formation of large scale platelet aggregates are possible without interruption of blood flow. A theoretical discussion of the effect of flow on various parameters which may be relevant to thrombus formation such as diffusion towards the surface, residence time near the surface, and stresses leading to detachment of material from the surface is presented. Preliminary results on glass indicate a one minute conditioning time before platelets settle followed by rapid attachment of platelets at a rate apparently limited by diffusion. The surface saturates with a monolayer of platelets until after 6–10 minutes large aggregates begin to form. Author

N69-15806# Joint Publications Research Service, Washington, D. C.
NEURON SENSITIVITY
M. L. Bykhovskiy et al *In its* Develop. in Autom. Control and Neuron Sensitivity 13 Jan. 1969 p 20–32 refs (See N69-15804 05-10)
Avail: CFSTI

The sensitivity of a neuron to variation of its parameters is investigated using a mathematical model of a neuron described by the system of Hodgkin–Huxley–Frankenhaeuser equations. The sensitivity equations are solved and analyzed for various types of excitation. Author

N69-15822# Howard Univ., Washington, D. C. Dept. of Biochemistry.
CHEMICAL EFFECTS OF IONIZING RADIATIONS ON THE INDIVIDUAL AMINO ACIDS WITHIN INTACT AND PURE PROTEIN MOLECULES Annual Progress Report, 1968–1969
Felix Friedberg 30 Oct. 1968 14 p refs
(Contract AT(30-1)-2735)
(NYO-2735-9) Avail: CFSTI

Exposure of lyophilized native ribonuclease or lysozyme in vacuo to about 30 Mrads caused aggregation of the protein molecules. There was no evidence of extensive degradation of these globular molecules. 5 *M* Guanidine CHl did not disassemble the aggregated material. If the S-carboxymethylated form of ribonuclease or lysozyme was exposed to gamma rays, there was also no indication of marked degradation of the polypeptide chain and again the molecules were prone to aggregate. On the other hand, lathyritic collagen exhibited a definite lowering of molecular weight, under the same conditions. Author (NSA)

N69-15848*# Aztec School of Languages, Inc., Acton, Mass. Research Translation Div.
SOME DATA ON THERMAL REGULATION IN *MUSCARDINUS AVELLANARUS*: CHANGE OF RESPIRATION CHARACTER AND BODY TEMPERATURE DURING DORMANCY AND ACTIVITY [NEKOTORYYE DANNYYE O TERMOREGULYATSII U ORESHNIKOVOY SONI *(MUSCARDINUM AVELLANARIUS)*. IZMENENIYE KHARAKTERA DYKHANIYA I TEMPERATURY TELA VO VREMYA SPYACHKI I BODRSTVOVANIYA]
A. G. Tomilin Washington NASA Jan. 1969 15 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 37, no. 1, 1958 p 120–130
(Contract NASw-1692)
(NASA-TT-F-12042) Avail: CFSTI CSCL 06P

The number of respiratory movements in the active *Muscardinus avellanarus* at a body temperature of 34.5° to 36° reaches 160 to 280 per minute in males, and 172 to 200 in females. During dormancy, the respiration undergoes drastic alterations: the number of respiratory movements decreases, and respiratory pauses of different durations arise (with a maximum up to 11 min). These pauses divide separate series of respiratory acts. The body temperature changes which are observed during dormancy are connected with a drop in the environmental temperature, and thus the number of respiratory movements increases, while the average duration of respiratory pauses decreases. When the environmental temperature drops to −5.5°, the animal awakes, and its body temperature attains the norm of an active one, i.e., 34.5°–36°. The body temperature of a hibernating animal increases with a rise in the environmental temperature, and the number of respiratory movements between pauses decreases, while the duration of the respiratory pauses increases. Author

N69-15896*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DISCUSSION OF THE *BACILLUS FUNICULARIUS* N.SP., AND A FEW REMARKS ABOUT THE *GALLIONELLA FERRUGINEA EHRENBERG*
A. J. Kluyver et al 1968 10 p refs Transl. into ENGLISH from Dutch
(Contract NAS7-100)
(NASA-CR-99110) Avail: CFSTI CSCL 20M

The bacteria strain, *bacillus funicularius* n.sp., was investigated. The colonies were prepared from the classical Beijernick formula which contained in addition to tap water agar, 2% glucose, 2% whiting, and 0.1% K_2HPO_4. This plate was inoculated with a liquid culture medium which contained the same nutrients and which had been previously infected with garden earth and incubated at 30°C for two days. An entangled fiber complex, surrounded by a thick mucous sheath, resulted. No cellular structure was observed in the fibers, and they were apparently filled with a homogeneous protoplasm from which several fine kernels distinctly protruded at various places. Further investigation with a potassium iodide treatment demonstrated that the fibers were composed of numerous cells which were 4 to 8μ long containing an abundance of glycogen. The physiological nature of the strain was studied as well as its behavior in other nutrient media, viz., wort agar, pea leaf agar, peptone agar, etc. B.P.

N69-15898*# Techtran Corp., Glen Burnie, Md.
THE PROBLEM OF SLEEP AND ITS LIMITATIONS IN PROLONGED SPACE FLIGHTS [PROBLEMA SNA I YEGO OGRANICHENIY PRIMENITEL 'NO KOSMICHESKIM POLETAM BOL 'SHOY PRODOLZHITEL 'NOSTI]
V. P. Zukhar Washington NASA Jan. 1969 9 p refs Transl. into ENGLISH from Russian Presented at the 3d Intern. Symp. on the Basic Environ. Problems of Man in Space, Geneva, 15–19 Nov. 1968
(Contract NASw-1695)
(NASA-TT-F-12098) Avail: CFSTI CSCL 06S

The principal space flight factors which may alter the sleep structure of man and influence sleep durations and phase correlations are: weightlessness and subsequent changes in information reaching the central nervous system; hypokinesia and hypodynamic consequences of weightlessness and the limited volume of spacecraft; nervous and emotional stress resulting from the danger, responsibility and loneliness of space flight; sensual deprivation, activity limitation and monotonous surroundings; changes in circadian rhythm, illumination levels, air temperature, noise background, etc. Data are presented from sleep investigations under conditions simulating space flight, as well as some physiological methods for controlling the type of sleep. A comparative evaluation is performed for various methods of organizing sleep and rest of astronauts during long space flights. Author

N69-15903*# Techtran Corp., Glen Burnie, Md.
INVESTIGATION OF THE INDUCTION OF DORSIVENTRALITY IN THE INCUBATING BODY EMBRYOS OF MARCHANTIAS. PART 3: LIGHT AS THE INDUCER OF DORSIVENTRALITY [UNTERSUCHUNGEN UBER DIE INDUKTION DER DORSIVENTRALITAT BEI DEN BRUTKORPERKEIMLINGEEN DER MARCHANTIEEN. 3. DAS LICHT ALS INDUKTOR DER DORSIVENTRALITAT]
Hans Fitting Washington NASA Jan. 1969 82 p refs Transl. into ENGLISH from Jahrb. Fur Wiss. Botan. (Germany), v. 85, 1937 p 169–242
(Contract NASw-1695)
(NASA-TT-F-12050) Avail: CFSTI CSCL 06S

In earlier experiments, the induction effect of gravity on dorsiventrality in marchantias in darkness was proven. In further experiments using artificial light in a black room, between 4 and 5 hours photostimulation was found to be sufficient for induction. The different effects of light in summer and winter are analyzed. Mood factors influencing development of the embryo are shown to be light and heat alone. Author

N69-15944*# Emory Univ., Atlanta, Ga.
[RADIATION MEASUREMENT OF RADIOBIOLOGICAL HAZARDS OF MEN IN SPACE] Annual Report, 1 Oct. 1967–30 Sep. 1968
Norman A. Baily 30 Sep. 1968 99 p refs
(Grant NGR-11-001-026)
(NASA-CR-99036) AVAIL: CFSTI CSCL 06R

Experiments were conducted to test the Blunck–Leisegang theory of the statistical distributions of small energy losses for pathlengths corresponding to those of biological interest. Preliminary results were obtained at 600 MeV. The Blunck–Leisegang correction was applied to the Vavilov distribution of energy losses in order to compare experimental data with a theoretical curve. The comparison shows some discrepancies between theory and

experiment out in the high energy tail regions of the distributions. Several possible reasons for this discrepancy are examined. Consideration is also given to experimental pulse height spectra distortions due to the effect of pulse pile-up. It is concluded that the predictions of the pile-up magnitude and the shape of the distorted spectrum are reasonable, and that these methods may be used to evaluate the effects of pile-up on experimental proton energy deposition spectra. Data outlines are included on the results of either animal or cellular radiation studies using protons as the source of incident radiation. M.G.J.

N69-15954# Joint Publications Research Service, Washington, D. C.

ANALYSIS OF PHYSIOLOGICAL MECHANISMS AND WAYS OF DEVELOPING THE ELECTROANESTHESIA METHOD

K. A. Ivanov-Muromskiy et al 27 Dec. 1968 9 p refs Transl. into ENGLISH from Modelirovanie v Biol. i Med. (Kiev), no. 3, 1968 p 97-103

(JPRS-45145) Avail: CFSTI

Observations on the neurophysiological mechanisms underlying electroanesthesia, a technique which has been effectively used in the treatment of acute radiation sickness, are presented. The importance of viewing the changes that take place at the systematic, as well as the molecular level, is emphasized. Soviet research has indicated that the three phase course of electroanesthesia in the integral organism is analogous to the states of anodic depression, catelectronic syndrome, and cathodic depression. Autocorrelation and cross correlation methods, as well as the periodogram converted to the spectral, were used to demonstrate these conclusions. The systematic reaction was also studied from the standpoint of modern neurophysiology and biocybernetics to distinguish between the fundamental and secondary formations. A.C.R.

N69-15971# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

NEW METHOD FOR STUDYING THE EFFICIENCY OF CHELATING AGENTS OF THE POLYAMINE ACID SERIES FOR INTERNAL DECONTAMINATION [METHODE NOUVELLE D'ETUDE DE L'EFFICACITE DES CHELATEURS DE LA SERIE DES ACIDES POLYAMINES POUR LA DECONTAMINATION INTERNE]

Jacques Lafuma, Jean-Claude Nenot, and Michele Morin Jun. 1968 21 p refs In FRENCH

(CEA-R-3519; EUR-3864.F) Avail: Issuing Activity

We followed the biological fate of a complex formed on one side with either a rare earth (^{144}Ce) or a transuranium element (^{239}Pu), and on the other side with a chelating agent of the polyamino acid series. This method allowed study of the in vivo stability of the various complexes and their comparison; the stability of the complexes as a function of the isotope-chelating agent weight relationships; and the metabolism of the chelating agents resulting in stable complexes, i.e. DTPA and TTHA. This simple method brought out the higher efficiency of DTPA in chelating rare earths and plutonium and for therapeutic purposes. Author (NSA)

N69-15981# Japan Broadcasting Corp., Tokyo. Technical Research Labs.

A MODEL OF RETINAL NEURAL NETWORKS AND ITS SPATIO-TEMPORAL CHARACTERISTICS

Minoru Yasuda and Kenji Hiwatashi Jan. 1968 23 p refs *Its* Ser. No. 116

(PB-179450) Avail: CFSTI CSCL 06D

A model of neural networks in the vertebrate retina based upon neurophysiological data was constructed. Its spatio-temporal characteristics were calculated with a digital computer, and compared with psychophysical data in human vision. This model consists of three neuron layers: input(receptor cell) layer, intermediate layer, and output (ganglion cell) layer. They are connected with each other in series (temporally) and in parallel (spatially), so that receptive fields are constructed. An analysis of these networks was carried out with matrix calculus in parallel connections and Mikusinski's operational calculus in series connections. Input-output relations for simple spatio-temporal input stimuli were obtained. The results have a good quantitative agreement with the fundamental psychophysical data of Mach and Broca-Sulzer phenomena, and spatial and temporal frequency responses of the human vision, if a time constant and a threshold level of inhibitory connections are higher than that of excitatory connections in the intermediate stage. Author (USGRDR)

N69-16052# Joint Publications Research Service, Washington, D. C.

POSSIBLE PATTERNS OF VESTIBULAR REACTIONS IN WEIGHTLESSNESS

Ye. M. Yuganov et al 6 Jan. 1969 9 p refs Transl. into ENGLISH from Zh. Ushnykh, Nosovykh i Gorlovnykh Bolezney (Kiev), Sep.-Oct. 1968 p 57-62

(JPRS-47189) Avail: CFSTI

Vestibular functions and the otolithic apparatus were studied during brief periods of weightlessness in a flying laboratory to determine the causes for the decline in performance due to vestibulosensory and autonomic reactions. The durations of post-rotation nystagmus, counterrotation illusion, and latency of rocking illusion were analyzed, and the nature and intensity of the vestibuloautonomic reactions to angular and Coriolis accelerations were determined. Recordings were made by tacho-oscillograms, kinetocardiograms, electrocardiograms, and pulse measurements from the femoral and radial arteries. Data were obtained which are indicative of the minimum, mean, lateral, pulse, and final systolic pressure, rate of propagation of the pulse wave, duration of the various phases of the cardiac cycle, and general peripheral resistance of the blood vessels. K.W.

N69-16078# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF ULTRAVIOLET LIGHT ON COLORLESS FLAGELLATES

M. M. Kamshilov 18 Jan. 1968 65 p refs Transl. into ENGLISH from Tr. Inst. Biol. Vnutr. Vod. Akad. Nauk SSSR (Moscow), no. 9, 12, 1965 p 255-299

(AD-678460; FTD-HT-23-1482-67) Avail: CFSTI CSCL 6/13

Present-day lower organisms - naked colorless flagellates - are capable of withstanding doses of shortwave ultraviolet radiation close in intensity to the intensity of the suns ultraviolet radiation which reached the surface in the preoxygen period of the earths existence. These data make it possible to answer one of the most important objections to photosynthesis in ultraviolet rays. The continuous link of the photosynthesis of the first organisms with the help of UV-photons with the abiogenic photosynthesis of organic compounds turns out to be entirely possible. Life as a cyclic process of the use in portions of the energy of the electron excitation of molecules by light photons will inevitably develop under conditions different from those of the earth, in readying the soil for the development of living creatures with their relatively closed internal metabolism, with the capacity for adaptation and progressive evolution. Author (TAB)

N69-16095# Sloan-Kettering Inst. for Cancer Research, New York.

BIOLOGICAL EFFECTS OF RADIATION AND RELATED BIOCHEMICAL AND PHYSICAL STUDIES. PROPOSAL NO. 4: CYCLOTRON FACILITY AND RADIONUCLIDE PRODUCTION Progress Report, 1 May 1967-1 May 1968

John S. Laughlin, Roy S. Tilbury, and James P. Mamacos 30 Sep. 1968 40 p refs
(Contract AT(30-1)-910)
(NYO-910-72) Avail: CFSTI

The design, operation, and performance characteristics of the multi-particle cyclotron at the Sloan-Kettering Institute for Cancer Research are discussed. The experimental facilities including targets and scattering chambers are described. The use of the cyclotron for production of radioisotopes, radioactive gases, and carbon-11-labeled organic compounds is examined. NSA

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N69-15372*# Systems Technology, Inc., Hawthorne, Calif.
MEASUREMENT OF PILOT DESCRIBING FUNCTIONS IN SINGLE-CONTROLLER MULTILOOP TASKS
Robert L. Stapleford, Samuel J. Craig, and Jean A. Tennant Washington NASA Jan. 1969 109 p refs
(Contract NAS2-3144)
(NASA-CR-1238; TR-167-1) Avail: CFSTI CSCL 05H

Problems of measuring pilot describing functions in multiloop tasks with one controller (i.e., where the pilot is controlling two, or more, response variables with a single manipulator are considered. Both direct and implicit measurement techniques were considered and tested experimentally. The experimental task used was attitude and altitude control with elevator of an aircraft in a simulated landing approach. Experimental results show that the measurement of multiloop describing functions is feasible, although the techniques are considerably more complex than those required for single-loop compensatory tasks. However, there are fundamental limitations on the accuracy of some of the results. These are discussed in detail. The experimental data also provide a spot check on the existing multiloop pilot model. The results support the current model and, in particular, show that the inner-loop (attitude) closure is quite similar to that for single-loop attitude tracking. Author

N69-15406# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WE STILL HAVE FOURTEEN MINUTES TO SPARE: THE STORY OF SPACE EQUIPMENT TEST PERSONNEL
N. Mel'nikov 19 Dec. 1967 8 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), 20 Nov. 1966 p 2 and 22 Nov. 1966 p 2
(AD-678437; FTD-HT-23-1379-67) Avail: CFSTI CSCL 5/9

The report tells the story of two space test pilots named only as Bogdan and Sergey. The first tested Voskhod ships and the later tested Vostoks. According to Bogdan, his duties consisted of testing the performance of space ships on the ground as well as their landing capabilities. The latter test was known as check-out test (kontrolnyy eksperiment). Bogdan also revealed that prior to the Voskhod series the astronauts had to land separately from the ship. Author (TAB)

N69-15448# Kansas State Univ., Manhattan. Inst. for Environmental Research.
PERFORMANCE AND LIFE SUPPORT IN ALTERED ENVIRONMENTS Interim Scientific Report, 1 Sep. 1967-1 Jul. 1968
Ralph G. Nevins 1 Aug. 1968 23 p refs
(Contract F44620-68-C-0020)
(AD-677679; AFOSR-68-2098) Avail: CFSTI CSCL 6/11

The three most significant scientific or technological accomplishments are as follows: (a) Systems Analysis of Optimization of Life-supported Systems; (b) Biological Rhythms; (c) Cooling Hood for Hot-Humid Environment. Author (TAB)

N69-15489# Department of National Health and Welfare, Ottawa (Ontario). Radiation Protection Div.
DATA FROM RADIATION PROTECTION PROGRAMS. VOLUME 6, NUMBER 1
Jan. 1968 33 p refs
(NP-17444-Vol-6-No-1) Avail: Issuing Activity

The problems involved in the application of international standards to radiation protection activities is reviewed in a general way. Solutions are not offered, rather the recommendations of the ICRP are examined in view of the Canadian situation in relation to nuclear activities. The areas discussed in the report include: the problem safety regulations for nuclear personnel, licensing of radioisotopes, public health action levels, population doses and dose apportionment, and the problem of medical exposure. Data are also presented in tabular form on the results of the Canadian fallout surveillance program. NSA

N69-15629*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
POTENTIAL PROBLEMS RELATED TO WEIGHTLESSNESS AND ARTIFICIAL GRAVITY
Ralph W. Stone, Jr. and William M. Piland Washington Jan. 1969 60 p refs
(NASA-TN-D-4980) Avail: CFSTI CSCL 06S

A study has been made of many publications to provide planners of future space missions with a summary of the pertinent problems associated with the weightless environment of space. Based on this study, a review is presented of the possible adverse effects of weightlessness on the astronaut's physiological processes and his performance in space. Techniques and devices which are potentially capable of counteracting the adverse effects of weightlessness are discussed. These counteractive measures include lower-body negative pressure devices, pressure cuffs, anti-g suits, the cardiovascular conditioning suit, exercise apparatus, and artificial gravity. The impact of additional weight and crew involvement in the inclusion of these devices on a particular mission is also discussed. The effects of these devices range from minor increases in launch weight and crew activity to significant vehicle-configuration complexity and astronaut involvement. Results are presented of research on the therapeutic value of the counteractive devices for weightlessness. Where an insufficient assessment of these devices exists, further research is recommended which could influence a decision on their use. Primarily, it is important to determine whether the effects of simulated weightlessness are progressive beyond that which has been experienced to date or whether the effects plateau at a specific level of physiological adaptation. Author

N69-15733# Los Alamos Scientific Lab., N. Mex.
LIQUEFIED HYDROGEN SAFETY—A REVIEW
F. J. Edeskuty and Roy Reider [1968] 12 p refs Presented at 10th Liquid Propulsion Symp., Las Vegas, Nev.
(Contract W-7405-ENG-36)
(LA-DC-9569; CONF-681102-1) Avail: CFSTI

The accident experience and accident potential in the use of liquefied hydrogen is examined with respect to cold damage to tissue, asphyxiation, hydrogen/air (O_2) mixtures, material properties, air and moisture condensation and pressure buildup. The control of liquefied hydrogen safety problems is reviewed in: facility design which includes site selection, materials of construction, hydrogen disposal, pressure relief (storage, insulation space, and experimental volumes) and control of spills; safe procedures which include standard operating procedures, safety training and education, emergency procedures, control of ignition sources; and operating

principles such as hydrogen monitoring, storage above atmospheric pressure, purging (before and after operations), inerting, leak control, chilldown procedures, venting procedures. Author (NSA)

N69-15776# Ionics, Inc., Cambridge, Mass.
AN ELECTROCHEMICAL CARBON DIOXIDE REDUCTION–OXYGEN GENERATION SYSTEM HAVING ONLY LIQUID WASTE PRODUCTS Final Report, May 1967–Mar. 1968
Floyd H. Meller Apr. 1968 43 p refs
(Contract N00014-66-C-0139)
(AD-678427) Avail: CFSTI CSCL 13/10

The electrochemical reduction of carbon dioxide has been investigated as a means of simplifying the disposal of carbon dioxide and hydrogen from a submarine atmospheric regeneration unit. Ejection of these materials as organic liquid wastes is preferable to the compression and gas phase discharge systems in current use. This investigation comprises phase II of the problem of developing an electrochemical cell to accomplish the desired reduction reactions. Conceptually, the cell consists of an anode at which water is electrolyzed to oxygen, a cathode at which carbon dioxide is reduced, and an electrolyte path between the two. A two stage reduction is required to balance the system metabolically consisting of the following general progression: Co2 yields HCOOH yields HCHO or CH3OH. Four cathode materials were found to catalyze the CO2 reduction. They are mercury, gallium, indium and the quaternary alloy Cerrolow 136. The latter material is most effective when used in the liquid phase. The reduction of HCOOH is accomplished to a limited degree on tin or Cerrolow 136. Author (TAB)

N69-15913# Naval Personnel Research Activity, San Diego, Calif.
TWO TRACK TRAINING FOR AVIONICS FUNDAMENTALS
Kirk A. Johnson and Phyllis A. Salop Sep. 1968 43 p refs
(AD-678348; STB-69-1) Avail: CFSTI CSCL 5/9

An experimental two track training system, developed for use in the Avionics Fundamental course, was evaluated against the conventional one track training system. The conventional course lasted 16 weeks. The two track system consisted of a regular track that was identical to the conventional 16-week course and an accelerated track that lasted 10 weeks. Students were graded on a scale with a maximum of 99, an (average) of 75, and a minimum passing grade of 63. Students in the two track system made grades that were, roughly, one point lower than those made by students in the one track system. This difference decreased to, roughly, half a point in subsequent courses. The two track system provided a reduction in training time of 1.38 weeks per student. This amounts to a savings of approximately 181 student man years per year. Author (TAB)

N69-16090# Joint Publications Research Service, Washington, D. C.
CYBERNETICS AND REGULATION THEORY
N. N. Krasovskiy 24 Dec. 1968 17 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 182, no. 6, 1968 p 1287–1289
(JPRS-47132) Avail: CFSTI

Conflicting problems of target approach at a given point in time were examined. It was discovered that the extremal aiming rule, based on the extremal points of the domain of accessibility of the pursued and pursuing motions, and modified from the point of view of generalized differential contingency equations, insures a saddle point for the game in the case under consideration. A thermodynamic adaptation model for application to automata theory is described by which the broad class of processes designated by the terms training, adaptation, etc., can be interpreted as relaxation processes in some physical system with a defined spectrum of energy levels in contact with a thermostat. An experiment on the mechanisms of habit using cats was conducted to study the possibility of switching external environments when developing a habit. The idea that an increase in excitability before habit formation and the habit itself reflect the development of negative training is contradicted. Habit formation in one analyzer should be considered as a protective process permitting the brain to avoid harmful effects of the external environment by switching attention to other analyzers. A.C.R.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-15028# Eidgenossische Technische Hochschule, Zurich (Switzerland).
CONTRIBUTION TO DIRECT COUPLING OF GAS CHROMATOGRAPHY AND PYROLITIC GAS CHROMATOGRAPHY WITH MASS SPECTROMETRY [BEITRAG ZUR DIREKTEN KOPPLUNG DER GASCHROMATOGRAPHIE UND DER PYROLYSEGASCHROMATOGRAPHIE MIT DER MASSENSPEKTROMETRIE]
Juerg Andres Voellmin (Ph.D. Thesis) 1967 68 p refs In GERMAN *Its* Dissertation No. 4057
Avail: CFSTI

Theory, instrumental arrangements, application possibilities, and limitations of combined gas chromatography/mass spectrometry methods are examined, especially for use in the thermal fragmentation of organic compounds and in the analysis of multicompounds. The instrumental arrangements that are described include one for use with packed separation columns as well as capillary systems, and a pyrolysis-gas chromatography system with high-frequency induction heating combined with mass spectrometry for the fragmentation of compounds in the micro-amount range with a high degree of reproducibility. The thermal fragmentation of a number of nitrophenylhydrazones was studied which involved mass spectrometric analysis by electron impact and high resolution structure determination. An analytical reciprocity between thermal fragmentation and electron impact fragmentation is pointed out. Included in the report is an extensive bibliography. Transl. by K.W.

N69-15033# National Lead Co. of Ohio, Cincinnati. Technical Div.
MODIFICATION OF A COMPUTER PROGRAM FOR CONVERTING ELECTRON MICROPROBE DATA TO TRUE CHEMICAL COMPOSITION
W. N. Wise Oct. 1968 42 p refs
(Contract AT(30-1)-1156)
(NLCO-1014) Avail: CFSTI

A program for the correction of microprobe data was modified for a computer-compiler with a maximum memory capacity of 32,000 characters by using two magnetic tape drives and chaining the program sections. The program, written in Fortran IV, stores all the parameters necessary for correcting X-ray intensity data. The only input data required are the chemical symbols of the elements in the system, the X-ray lines analyzed, the accelerating potentials, and the X-ray intensities. Author (NSA)

N69-15040# Technische Hochschule München (West Germany).
IR SPECTROSCOPIC RESEARCH AND APPROXIMATE CALCULATION OF THE NITROGEN HALIDE COMBINATIONS [IR-SPEKTROSKOPISCHE UNTERSUCHUNGEN UND NAEHERUNGSRECHNUNGEN AN STICKSTOFF-HALOGENVERBINDUNGEN]

Karl Hoehne (Ph.D. Thesis) [1968] 63 p refs In GERMAN
Avail: CFSTI

The infrared spectra of halogenated dimenthyl amine, N-methyl acetamide, acetamide, and succinimide are analyzed for their nitrogen–halogen valence vibrations and all obtained frequency data are presented in table form. It is shown that most absorption frequencies of NCl valence vibrations are between 600 and 635 cm^{-1}. A two-mass containing model, where the NH_2 group is $m_{NH_2} = 16$ and the bromide group is $m_{Br} = 79.9$, is used to determine the NBr-valence vibration constant in NH_2Br as 2.28 mdyn/Å. Transl. by G.G.

N69-15045# Eidgenossische Technische Hochschule, Zurich (Switzerland).
RESEARCH ON CARBENE METAL COMPLEXES [VERSUCHE UM CARBEN-METALL-KOMPLEXE]
Helmut Neumann (Ph.D. Thesis) 1968 58 p refs In GERMAN /ts Dissertation No. 4049
Avail: CFSTI

The reaction of steroid bases with dineopentoxycarbonium tetrafluoroborate formed the intermediate dineopentoxycarbene neopentyl dineopentoxy acetate for neopentyl 2, 2, 3, 3 tetraneopentoxypropionate isolation. Copper catalysis was used to separate nitrogen from diazo complexes for carbene synthesis. N, N dimethylformamide dimethylacetal produced corresponding epoxides with cis-cyclohexane 1, 2-diol, meschydrobenzoine and 5 α, 6 β dihydroxycholestane. Transl. by G.G.

N69-15078# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
APPLICATION OF ANALYSIS BY SPECTROMETRY OF X-FLUORESCENCE RADIATION. DETERMINATION OF P–W–Zr IN PHOSPHOTUNGSTATE, ZIRCONIUM TUNGSTATE, ZIRCONIUM PHOSPHATE, THEIR MIXTURES, AND THEIR DEGRADATION PRODUCTS [APPLICATION DE L'ANALYSE PAR SPECTROMETRIE DU RAYONNEMENT DE FLUORESCENCE X. DOSAGE DE P–W–Zr DANS LES PHOSPHOTUNGSTATE, TUNGSTATE DE ZIRCONIUM, PHOSPHATE DE ZIRCONIUM, LEURS MELANGES ET LEURS PRODUITS DE DEGRADATION]
Andre Guillon et al Jun. 1968 39 p refs In FRENCH
(CEA-R-3474) Avail: CFSTI

By chemical methods it is possible to determine accurately the constituents of solid samples containing essentially P, Zr, and W. The use of the X-ray fluorescence technique for this determination is discussed. The process used is the borax-bead method. Fusion eliminates heterogeneity effects such as those due to the size, porosity, and composition of the grains. Interelement effects, however, are not suppressed. These effects were studied and corrections made for them. Author (NSA)

N69-15100 Wisconsin Univ., Madison.
MULTICOMPONENT DIFFUSION IN LIQUIDS: A NEW EXPERIMENTAL TECHNIQUE
Louis Edward Furlong (Ph.D. Thesis) 1968 317 p
Avail: Univ. Microfilms: HC $14.40/Microfilm $4.10 Order No. 68-5305

The importance of diffusional interaction in ternary liquid solutions was investigated both experimentally and theoretically. The experimental portion of the program included development of a new and potentially accurate method for determination of diffusion coefficients in either binary or ternary systems. The theoretical portion of the program consisted primarily of an extension of the hydrodynamic theory to mixed large solutes at finite concentration. Diffusion coefficients were determined using a diaphragm cell and continuous monitoring of refractive-index difference as a measure of composition. This technique coupled with nonlinear regression analysis of the raw data proved capable of high accuracy and operational simplicity. Further development of both equipment design and experimental procedure is needed to achieve full potential of the method. A simple hydrodynamic model was developed for ternary systems of large spherical solutes in a solvent of smaller molecules. Dissert. Abstr.

N69-15114 Lehigh Univ., Bethlehem, Pa.
MEASUREMENTS OF TRANSPORT NUMBERS IN SILVER CHLORIDE AT HIGH TEMPERATURES
Edward Arlen Roeder (Ph.D. Thesis) 1967 44 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-4905

Anionic transport numbers, n_-, (the fraction of charge transported by anions in ionic conduction) have been measured in pure silver chloride in the temperature range 398°C to 444°C. The results indicate that $0.0 \leq n_- \leq 0.01$. Values predicted from tracer self-diffusion measurements of chlorine in silver chloride by Compton fall in the lower portion of this range. No temperature dependence of transport number was detected. The mechanism of this anionic transport remains a mystery. The results are discussed in terms of possible models of anion disorder. It is concluded that anion vacancies are unlikely, while anion interstitials, if present, must be highly immobile. Dissert. Abstr.

N69-15132# United Kingdom Atomic Energy Authority, Harwell (England). Information Branch.
NITROGEN DETERMINATION IN CERAMIC URANIUM COMPOUNDS
A. Naoumidis, H. Nickel, J. Rottmann, and H. J. Stoecker Jul. 1967 22 p refs Transl. into ENGLISH from Z. Anal. Chem. (Berlin), no. 226, 1967 p 175–192
(NP-TR-1687) Avail: Issuing Activity

The procedure for determining the nitrogen content in ceramic uranium compounds is reported. UN_{1+x} ($0 \leq x \leq 0.80$) and U(C,N) compounds with high N_2 concentration as well as uranium carbides with nitrogen impurity content below 100 ppM were investigated, using modified conventional methods. Results are discussed in detail. The applicability of three analytical methods was confirmed by the agreement of the nitrogen results within the error limits. The coefficient of variation in the results yielded by the Dumas method, irrespective of the sample composition, was more favorable than that of the Kjeldahl method. The hot-extraction method also yielded exact results when UN_{1+x} compounds were analyzed. By applying both the Dumas and the Kjeldahl methods it was possible not only to determine quantitatively the nitrogen in nitride compounds but also the nitrogen in powdered materials, where it is possibly adsorbed in molecular form. Author (NSA)

N69-15134# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE CHEMISTRY OF PROPELLANT CONSTITUENTS [CHIMIE DES CONSTITUANTS DE PROPERGOLS]
Bernard Crampel Jul. 1968 371 p refs In FRENCH; ENGLISH summary
(ONERA-NT-113) Avail: CFSTI

An extensive review is presented of the constituents of propellants available for chemical propulsion. The main chemical and physical properties and the utilization conditions of the constituents of propellants are collected in the form of monographs, tables, and curves. The most recent results are taken into account. The material is arranged as follows: (1) definition of the properties required from propellant constituents; (2) search of the interesting constituents for propulsion; (3) oxidizer chemistry; and (4) fuel chemistry. Author

N69-15145# Industrial Science and Technology Agency, Tokyo (Japan). Electrotechnical Lab.
ELECTRON SPIN RESONANCE STUDY OF COPPER MANGANESE DILUTE ALLOYS

Akira Nakamura Jun. 1968 35 p refs *Its* Res. No. 685
Avail: CFSTI

An electron spin resonance study was carried out on dilute copper manganese alloys over a temperature range from 1.8° to 300°K. Distortion of the line shape due to the high electrical conductivity in these alloys is examined carefully, and reliable values are obtained for linewidths and *g*-values. The linewidth is found to increase linearly with temperature over the temperature range where the susceptibility obeys Curie–Weiss' law. Author

N69-15158 IIT Research Inst., Chicago, Ill.
DISPERSION WITH ADSORPTION IN PACKED BEDS AND RESIDENCE TIME DISTRIBUTION IN FLUIDIZED BEDS
Yeshoshua Dayan (Ph.D. Thesis) 1968 226 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-7782

The problems of dispersion in packed beds of porous adsorbent solids and of finding the residence time distribution of gas in fluidized beds were investigated. To solve the first problem a theoretical study of solute dispersion in tubes and porous beds was made. The dispersion coefficient was calculated for a general packed-bed model. The model studied consists of a long tube having a distribution of straight pores along its walls. A tracer injected into the fluid flowing through the system is convected by the fluid, diffuses across the tube and into the pores (filled with stagnant fluid) and is adsorbed onto the pore walls and bottoms. These three effects—convection and radial diffusion in the tube, diffusion in the pores, and adsorption onto the walls—are combined to form an effective volume which was found to be larger than the actual volume of the system. This effective volume holds the solute in the system and effects the dispersion and residence time distribution in the system. Dissert. Abstr.

N69-15160 Colorado State Univ., Fort Collins.
DIFFUSION OF TRAPPED GAS FROM POROUS MEDIA
Kenneth Morgan Adam (Ph.D. Thesis) 1967 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-7807

The purpose of this study was to develop and test equations that describe the process whereby a gas which is in isolated pockets surrounded by a liquid, diffuses in one direction from a porous media. The equation developed by Bloomsburg and a similar equation developed by introducing one simplifying assumption beyond those made by Bloomsburg were tested. Experimental results show that neither of these developments adequately describe the process. A graphical method developed from observing the trends of the experimental data is given. It is based upon extrapolation of experimental data obtained from cores obtained in the field from the material of interest. Besides giving the time that full liquid saturation would occur, this method allows the liquid distribution to be estimated at any time by use of normalized curves which relate air content to dimensionless length, using dimensionless time as a parameter. Dissert. Abstr.

N69-15180# Union Carbide Nuclear Co., Paducah, Ky. Gaseous Diffusion Plant.
ANALYTICAL PROCEDURES FOR URANIUM HEXAFLUORIDE SPECIFICATIONS
R. W. Levin and V. G. Katzel 13 Jun. 1968 74 p Revised
(Contract W-7405-ENG-26)
(KY-L-454-Rev-1) Avail: CFSTI

Analytical procedures used for specification analysis of UF_6 at the Paducah Plant Laboratory are compiled. NSA

N69-15188 IIT Research Inst., Chicago, Ill.
PHASE EQUILIBRIUM FOR ETHANE-PROPANE SYSTEM AT LOW TEMPERATURES
Ljubomir Djordjevich (Ph.D. Thesis) 1968 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-7828

The vapor-liquid equilibrium of the Ethane-Propane binary system was experimentally studied at low temperatures down to the point where the system started exhibiting ideal solution behavior. The experiments were conducted at 0°F, −50°F, −100°F, −150°F, −200°F, and −230°F isotherms. The overall pressure range was from 0.094 mm Hg abs. to 218 psia. The ideal solution behavior was detected at −230°F, but for all practical purposes the system may be considered as ideal even at −200°F. A method of predicting the composition of both phases for a given temperature and pressure, taking into account the virial coefficients and vapor pressures of pure components, was also developed. A special phase equilibrium apparatus was developed with the specific requirement that it be suitable for both low and elevated temperatures and high vacuum as well as high pressure studies, without the possibility of disturbing equilibrium during the sampling. Dissert. Abstr.

N69-15197# Union Carbide Nuclear Co., Oak Ridge, Tenn. Gaseous Diffusion Plant.
ADSORPTION OF URANIUM HEXAFLUORIDE ON FIXED BEDS OF SODIUM FLUORIDE
L. W. Anderson 19 Sep. 1968 11 p refs
(Contract W-7405-ENG-26)
(K-L-6221) Avail: CFSTI

Fixed-bed adsorption tests were completed that further define the adsorption behavior of the UF_6–NaF system. Results are presented to establish a better understanding of the dependence of the adsorption behavior on various physical parameters, such as temperature, total gas flow rate, and pellet properties. The effect of repeated adsorption–description cycles on the physical structure of NaF pellets is also presented. NSA

N69-15213# Commissariat a l'Energie Atomique, Chusclan (France). Centre de Production de Plutonium de Marcoule.
STUDY OF VARIOUS DECONTAMINATION PROCESSES FOR EVAPORATION CONCENTRATES [ETUDE DE DIFFERENTS TRAITEMENTS DE DECONTAMINATION SUR DES CONCENTRATS D'EVAPORATION]
Guy Lefillatre, Yvonne Cudel, and Lucienne Rodi Sep. 1968 48 p refs In FRENCH
(CEA-R-3554) Avail: CFSTI

Generally speaking, the evaporation concentrates are in the form of acid solutions of high salt content, about 400 g/l. The specific activity is very variable: from 0.5 mCi/l to many hundreds of Ci/l. Because of the high solubility of these salts, an attempt has been made to render the radioelements insoluble in the concentrates before their possible coating with bitumen. With this in view, the possibility of fixing them on inorganic products, of precipitating them in the form of insoluble salts, or of adsorbing them on coprecipitates has been considered. The technique consists of carrying out the precipitations (hydroxides, specific processes for ^{90}Sr and ^{137}Cs) one after the other without separating the precipitates. Author (NSA)

N69-15214# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Radiochemie.
PHASE EQUILIBRIUM IN THE SYSTEMS UO_{2+x} $LuO_{1.5}$ ($ErO_{1.5}$) AND $LuO_{1.5}$ UO_2 (NpO_2, NpO_{2+x}, PuO_2, PuO_{2+x})
Udom Sriyotha Apr. 1968 61 p refs In GERMAN
(KFK-737) Avail: CFSTI

The systems $LuO_{1.5}$–UO_2(UO_{2+x}, NpO_2, NpO_{2+x}, PuO_2 PuO_{2+x}) and $ErO_{1.5}$–UO_{2+x} were investigated in the temperature range from 1270 to 1700°C and under 1 atm

O_2 or under no oxygen. The width of the oxide phases formed in the individual systems was determined as a function of the individual parameters. Author (NSA)

N69-15223# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
AEROSOLS PRODUCED BY EVAPORATION OF A URANIUM WIRE [AEROSOLS PRODUITS PAR EVAPORATION D'UN FIL D'URANIUM]
Colette Morel (Ph.D. Thesis—Paris Univ.) Mar. 1968 53 p refs In FRENCH
(CEA-R-3473) Avail: CFSTI

The aerosols formed when a uranium wire is evaporated in a normal or rarefied atmosphere, either with or without a drying agent are investigated. The heating of the wire can be either fast or slow. Aerosol production apparatus and methods of measuring aerosols are discussed and the results obtained with various aerosols are described. The particles produced by the wire are found to be less than one micron. During rapid heating, the granulometric distribution of the aerosol obeys a log-normal law. During slow heating, the distribution has two modes: one near 0.05 μ, the other close to 0.01 μ. Author (NSA)

N69-15235# Lexington Labs., Inc., Cambridge, Mass.
PROPERTIES OF THE COMPOUNDS RUBIDIUM MANGANESE TRIFLUORIDE, POTASSIUM MANGESE TRIFLUORIDE, AND CESIUM MANGANESE TRIFLUORIDE
Joan S Friebely and William J. Ince 8 Aug. 1968 25 p refs *Its* 33rd Reference Bibliog.
(Contract AF 19(628)-5167)
(AD-677285; ESD-TR-68-240) Avail: CFSTI CSCL 20/3

This bibliography lists publications related to the double fluorides XMNF3, where X is K, RB or CS. These materials are antiferromagnetic with neel temperatures of 88.3°K, 82.6°K and 53.5°K, respectively. Considerable interest has been shown in their properties since about 1960. They are characterized by having large exchange (HEX about 10 to the 6th power OE) and small crystalline anisotropy (H <10 OE). Antiferromagnetic resonance (AFMR) can be observed, therefore, at microwave frequencies without the need for very large magnetizing fields. Further, there is a strong hyperfine interaction that causes pronounced coupling between the nuclear magnetic resonance (NMR) of the Mn(55) nuclei and the AFMR modes. Hence much of the published work to date has dealt with magnetic resonance. Author (TAB)

N69-15240# Battelle Inst., Frankfurt am Main (West Germany).
STUDY OF CHEMICAL REACTIONS BETWEEN URANIUM DIOXIDE, THE MOST ABUNDANT FISSION PRODUCTS, WATER AND SODIUM
N. Henzel and A. Kleine-Tebbe Washington AEC 25 Apr. 1968 97 p refs Sponsored by Federal Min. of Sci. Res.
(AEC-TR-6961)

Chemical reactions between UO_2 fuel, the main fission product elements with regard to quantity and radioactivity, and water and sodium coolants are investigated for temperatures between 1000 and 3000°K. The relevant reaction equilibria of such systems is calculated and graphically extrapolated to high temperatures beyond the region of known thermodynamic data. From the reaction potentials obtained and the estimated initial mole concentrations of the reactants, the amounts of thermodynamically stable reaction products are determined as a function of temperature. NSA

N69-15249# Los Alamos Scientific Lab., N. Mex.
THE X-RAY FLUORESCENCE SPECTROMETRIC DETERMINATION OF TANTALUM AND TUNGSTEN
E. A. Hakkila, S. N. Deming, and R. G. Hurley 15 Oct. 1968 9 p ref
(Contract W-7405-ENG-36)
(LA-4007) Avail: CFSTI

Tantalum and tungsten, when present at concentrations between 5 and 95% in various materials, are measured by X-ray spectrometric methods. For analysis of binary mixtures, the sample is dissolved in a mixture of hydrofluoric and nitric acids, the solution is irradiated using a molybdenum-target X-ray tube, and the intensity of the $L\alpha_1$ X-ray for tantalum or tungsten is measured. The concentration of tungsten or tantalum is determined by comparing the X-ray intensity with intensities measured for solutions having known tungsten or tantalum concentrations. The relative standard deviations of the line intensity method are in the range between 2 and 1% for determining concentrations between 5 and 95% of tungsten or tantalum. An internal standard method is used for analysis of more complex mixtures; this method is applicable also to the analysis of binary mixtures. The sample is dissolved in hydrofluoric and nitric acids, an internal standard is added, and the solution is irradiated using a molybdenum-target X-ray tube. Author (NSA)

N69-15265# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE CREATION OF MATTER
I. Knunyants 20 Dec. 1967 11 p Transl. into ENGLISH from Izv. (Moscow), 24 Feb. 1967 p 1–4
(AD-678401; FTD-HT-23-1390-67) Avail:CFSTI CSCL 7/3

A popularized discussion is given of the goals and achievements of modern chemical research. TAB

N69-15270 Ohio State Univ., Columbus.
NUCLEAR MAGNETIC RESONANCE STUDIES IN SOLID DEUTERIUM
Malcolm Jules Smith (Ph.D. Thesis) 1967 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-8881

Transient NMR methods are employed to investigate the nature of the rotational ordering in solid deuterium both above and below the temperature of the λ-transition. Spin-lattice relaxation times are measured by means of the saturation-τ-90° pulse sequence technique. Relaxation times are given as a function of ortho-para concentration (2% to 82% p-D_2) at 4.2°K. For concentrations between 62% and 82% p-D_2 the relaxation times are reported as a function of temperature (1.2° to 4.2°K). The signal from the free induction decay after the completely relaxed sample has been given a 90° pulse has been measured as a function of temperature for samples which undergo the λ-transition. Dissert. Abstr.

N69-15271 Illinois Univ., Urbana.
MICROWAVE ZEEMAN EFFECTS IN 1 TO 10 cm WAVE LENGTH REGION
Mei-Kuo Lo (Ph.D. Thesis) 1967 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-8150

The Zeeman effects in the microwave rotational spectra of some linear and asymmetric-top molecules have been investigated in 1 to 10 cm wavelength region with conventional 5KHz Stark modulated microwave spectrometer. A Varian electromagnet with cylindrical pole cap of 11.9 inches in diameter and 2.25 inches in air gap was used. The maximum available magnetic field is about 11 kilogauss. Various waveguide absorption cells were constructed to improve the sensitivity and the resolving power of the spectrometer. The σ-component doublet spectra ($\Delta M = \pm 1$) of several rotational transitions were observed for $CH_2=CF_2$, OCF_2, and CH_2F_2. The Zeeman effect of formaldehyde was also re-examined. Dissert. Abstr.

N69-15278# Los Alamos Scientific Lab., N. Mex.
A COMPUTER PROGRAM FOR CALCULATION OF PARTICLE SIZE DISTRIBUTION FROM SEDIMENTATION DATA
J. D. Olson and G. M. Campbell 30 Sep. 1968 21 p refs
(Contract W-7405-ENG-36)
(LA-4001-MS) Avail: CFSTI

A new mathematical method of obtaining particle size distribution from sedimentation data is developed from the same assumptions as the traditional Oden method. The main advantage of this method is that it eliminates the necessity of drawing tangents required by the Oden method. A computer program to solve the simultaneous system of equations obtained from this theory and to calculate the distribution results is described. A comparison was made of results obtained from a typical sedimentation experiment using this method and the Oden method. Author (NSA)

N69-15279# Eidgenossische Technische Hochschule, Zurich (Switzerland).
CONTRIBUTION TO THE PYROLYSIS GAS CHROMATOGRAPHY MASS SPECTROMETRY AND THE PYROLYSIS RADIO CHROMATOGRAPHY OF ORGANIC COMPOUNDS [BEITRAG ZUR PYROLYSE-GASCHROMATOGRAPHIE MASSENSPEKTROMETRIE UND PYROLYSE-RADIO GASCHROMATOGRAPHIE ORGANISCHER VERBINDUNGEN]
Hans-Peter Kriemler (Ph.D. Thesis) 1967 90 p refs In GERMAN
Its Dissertation No. 4039
Avail: CFSTI

The thermal fragmentation of benzoic acids, various amino acids, and several dipeptides by means of a routine method using high-frequency induction heating was studied. Fragments resulting from the pyrolysis were identified by a method combining gas chromatography and mass spectrometry. The reaction kinetics of thermal fragmentation were studied in the benzoic and amino acids using isotopic labeling with carbon 14 and radiography with gas chromatography. Product analysis of the fragments by the pyrolysis method clearly identifies the amino acids. Pyrolysis/gas chromatograms of several simple dipeptides were found to be linear superpositions of the corresponding chromatograms of amino acids; for the analysis of higher peptides, however, the reliability of the method remains questionable. In the pyrolysis of various substituted benzoic acids, it was possible to identify substituents without difficulties; however, a differentiation of position isomers was not possible. The phenyl nucleus remains largely intact during the pyrolysis. Aside from the unavoidable secondary reactions during thermal fragmentation, the pyrolysis products could be correlated with those resulting from electron bombardment. Transl. by K.W.

N69-15285 Columbia Univ., New York.
NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY IN LIQUID CRYSTALS
Gerald Paul Ceasar (Ph.D. Thesis) 1967 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-8568

By analyzing the nuclear magnetic resonance of molecules dissolved in nematic liquid crystals, we have been able to measure the anisotropy of the chemical shielding tensor, a parameter for which there are little experimental data. In these studies the ordered environment of the liquid crystal solvent served to orient solute molecules while the magnetic resonance experiment was carried out. Anisotropies were determined for a large number of molecules in a variety of bonding situations: the methyl halides, trifluoromethyl iodide, trichloromethylsilane, acetylene, and cyclopropane. The data were used to critically evaluate simple approximate theories of proton shielding. It was found that the frequently used magnetic dipole model is inadequate to explain the observed proton shielding anisotropies. Dissert. Abstr.

N69-15288 Minnesota Univ., Minneapolis.
EFFECT OF EXCITING WAVELENGTH AND FOREIGN GASES ON FLUORESCENCE AND INTERSYSTEM CROSSING IN BENZENE VAPOR
Teh-hsuan Chen (Ph.D. Thesis) 1967 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-7288

The fluorescence yield of benzene vapor at certain excitation energies was found to decrease with decreasing exciting wavelength. Below 2400Å no emission could be observed. Within the pressure range studied from 5 to 70 torr, self-quenching was found to be negligible. Intersystem crossing to the triplet state (as determined by sensitized biacetyl emission) was also found to be markedly dependent on exciting wavelength. At the longest exciting wavelength of *ca.* 2590Å, the sum of the fluorescence yield and triplet state formation yield was found to be close to unity. However, strong deviations from unity were found at shorter exciting wavelengths. Foreign gases were generally found to enhance the fluoresence. The fluorescence and sensitized emission yields at "infinite" pressure of foreign gas were found to remain strongly dependent on exciting wavelength. A suggested mechanism consistent with most of our results is discussed. Dissert. Abstr.

N69-15289 Illinois Univ., Urbana.
STUDIES OF ELECTRON DELOCALIZATION IN PARAMAGNETIC METALLOCENES
Michael Francis Rettig (Ph.D. Thesis) 1967 225 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order 68-8203

The nuclear magnetic resonance contact shifts of the paramagnetic metallocenes have been re-interpreted on the basis of a sigma and π electron delocalization model. The earlier electron delocalization model given by Levy and Orgel was shown to be inadequate when put to an experimental test. Thus, the earlier delocalization scheme requires the weakly bonding unpaired a'_{1g} and e_{2g} electrons on chromium and vanadium to polarize the paired cyclopentadiene π electrons. This polarization ultimately leads to negative spin density on the carbon and positive spin density on the hydrogens. In this way the "anomalous" negative contact shifts were explained. In the present work it was found that the methyl contact shifts of 1,1'-dimethylvanadocene and 1,1'-dimethylchromocene are also negative, and much smaller in absolute magnitude than the negative ring contact shifts. This result is in complete disagreement with the Levy-Orgel model, which predicts that negative spin density should appear at the methyl hydrogens, giving large positive contact shifts. Dissert. Abstr.

N69-15291 Illinois Univ., Urbana.
A STUDY OF THE PLATINUM BASE MERCURY FILM ELECTRODE
Allen Gene Hiebert (Ph.D. Thesis) 1967 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-8109

The preparation and electrochemical behavior of the platinum base mercury film electrode were studied. Evidence for the existence of a Pt-Hg compound at the platinum-mercury interface is presented. A preparation technique of plating mercury at constant current combined with vigorous cathodization in dilute acid results in reproducible, uniform mercury films on the metal base. The consequences of using a thin film electrode for amalgam forming systems have been examined. It is shown that in cyclic voltammetric experiments, the cathodic and anodic peak potentials are dependent on the sweep rate and film thickness. The anodic peak current is shown to be a function of sweep rate, film thickness, and switching potential. This complex dependence of the data on experimental parameters decreases the utility of cyclic voltammetry as a method for investigating behavior at a mercury film electrode. Dissert. Abstr.

N69-15300 Illinois Univ., Urbana.
A STUDY OF DIRECT SOLUTION ANALYSIS WITH A NEW HOLLOW-CATHODE DISCHARGE SYSTEM
Peter John Zanzucchi (Ph.D. Thesis) 1967 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-8278

In this study the new concept of generating a highly reactive molecular filler gas by the hollow-cathode discharge for the sensitive, quantitative excitation of solutes (cations) in microliter volumes of solution sample has been demonstrated using a demountable hollow-cathode source. The lining of the hollow cathodes with potentially reactive materials (e.g., graphite) provides for unique chemical-physical filler gas systems. As a result of the studies with the demountable hollow cathode and chemically active filler gases, a direct solution technique for sampling has been developed. In general, the sampling of solutions directly eliminates analytical dependence on conventional sputtering mechanisms which could influence the precision of the method. The direct solution sampling technique provides good short-term, efficient (bulk) emission and thus contributes to good sensitivity. Dissert. Abstr.

N69-15301 Columbia Univ., New York.
ELECTRONIC STRUCTURES OF CERTAIN TRANSITION METAL CARBONYLS
Nancy Ann Beach (Ph.D. Thesis) 1967 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8563

Electronic structures for the octahedral neutral d^6 Group VIB hexacarbonyls—$Cr(CO)_6$, $Mo(CO)_6$ and $W(CO)_6$, for the isoelectronic ionic hexacarbonyls $V(CO)_6^-$, $Mn(CO)_6^+$, and $Re(CO)_6^+$, and for the non-octahedral carbonyls, $Fe(CO)_5$ and $HMn(CO)_5$, have been calculated by the self-consistent charge and configuration molecular orbital (SCCC–MO) method. Ultraviolet absorption spectra for these species at room temperature (300°K) and in some cases at low temperature (77°K) are interpreted and correlated with the calculated energy level schemes. The bonding in these carbonyls is discussed with special reference to the role of back donation. Quantitative measures of back donation determined from electronic spectra are compared with calculated values and the effects of charge and the importance of π bonding for back donation are described. Dissert. Abstr.

N69-15307# Technische Hochschule Munchen (West Germany).
USE OF A MODIFIED MIM MODEL TO DEMONSTRATE THE CONNECTION BETWEEN ELECTRON SPECTRA OF RELATED STRUCTURES. TREATMENT OF MOLECULES COMPOSED OF BENZENE RING, KETO GROUP AND SULPHUR [VERWENDUNG EINES MODIFIZIERTEN MIM-MODELLS ZUB BESCHREIBUNG DER ZUSAMMENHAENGE IN DEN ELEKTRONENSPEKTREN VERWANDTER VERBINDUNGEN. BEHANDLUNG VON MOLEKUELEN, DIE AUS DEN BAUSTEINEN BENZOLRING, KETOGRUPPE UND SCHWEFELATOM BESTEHEN]
Karlheinz Giovanelli (Ph.D. Thesis) 1968 103 p refs In GERMAN
Avail: CFSTI

The MIM (Molecules In Molecules) model is improved and extended to permit a better description of the oscillatory strengths and energies of electron transfers for π electrons and to permit a description of a larger number of molecules which are composed in various ways of several partial systems. Of particular interest were the relationships and analogies in the electron spectra of several compounds which, starting from benzaldehyde and thiophanol, are formed by the successive extension of partial systems. A mathematically meaningful formulation of the MIM method requires a modification of the approximation for the γ integrals in order to improve the representation of experimental spectra. The interchange between the partial systems can be better described on the basis of a generalized coupling concept, for which an empirical function $\beta(R)$ was derived that gives the resonance integral β as a function of distance to the center R. The use of effective ionization energies I_D and electron affinities A_A for the partial systems is justified; the inductive effect of substituents, heretofore not negligible, can be considered in the present form of the model only in the I_D or A_A values that are used. The modified method was successfully applied to large molecules of anthrone, anthraquinone, thioxanthene, thianthrene, and thioxanthone. Transl. by K.W.

N69-15319# Technische Hochschule Munchen (West Germany).
SPECTROSCOPIC INVESTIGATIONS OF PSEUDOHALOGENIC-METAL COMPOUNDS AND REACTIONS OF COMPLEX METAL AZIDES [SPEKTROSKOPISCHE UNTERSUCHUNGEN AN PSEUDOHALOGENO-METALLVERBINDUNGEN UND REAKTIONSWEISEN KOMPLEXER METALLAZIDE]
Wolf Peter Fehlhammer (Ph.D. Thesis) 1968 98 p refs In GERMAN
Avail: CFSTI

Analyzed are vibration, absorption, and reflection spectra of homogeneous azido-metal complexes of transition metals and of phosphine containing azide compounds. Position and coordination of d-d bonds in the metal azide compounds put the azide ligands into the spectrochemical ($N_3^- \leq F^-$) and nephelinic ($N_3^- \approx J^-$) class of ligands. The metal-azide bond shows a pronounced covalent character. Wave frequencies for electron charge transfers between azide ligands to metal established electro-o negative values for the azide ion as 2.7 to 2.8. Transl. by G.G.

N69-15322# Technische Hochschule Munchen (West Germany).
A NEW MODEL FOR INTERPRETING ELECTRONIC PROPERTIES OF ORGANIC MOLECULES [EIN NEUES MODELL ZUR INTERPRETATION DER ELEKTRONISCHEN EIGENSCHAFTEN ORGANISCHER MOLEKUELE]
Siegfried Schneider (Ph.D. Thesis) 1968 153 p refs In GERMAN
Avail: CFSTI

Developed is a mathematical model for calculating the electronic properties of organic molecules from an approximated valence electron scheme by substituting the metric matrix with a reduced S-matrix to find the orbital groupings. Computer example calculations on nuclear charges utilizing this "Partial Neglect of Differential Overlap Model" showed good agreement with established values. Transl. by G.G.

N69-15341# Mound Lab., Miamisburg, Ohio.
A STATISTICAL EVALUATION OF SELECTED ANALYTICAL PROCEDURES
D. R. Bohl and D. E. Sellers 24 Sep. 1968 14 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1515) Avail: CFSTI

A data evaluation study was conducted to evaluate the precision and accuracy of analytical procedures. Conventional statistical formulas were used to evaluate the data. The procedures evaluated statistically were: a potentiometric method for determining iron and uranium, a volumetric titration of nickel, and the determination of uranium by controlled-potential coulometric and potentiometric titration. The accuracy, standard deviation, and confidence intervals were calculated using historical data from these procedures. Author (NSA)

N69-15342# Mound Lab., Miamisburg, Ohio.
SPECTROPHOTOMETRIC DETERMINATION OF FLUORIDE IN PLUTONIUM WITH ZIRCONIUM-ERIOCHROME CYANINE R
P. L. Redding, C. T. Bishop, and D. E. Sellers 24 Sep. 1968 10 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1544) Avail: CFSTI

A simple and rapid spectrophotometric method for the determination of 10 to 70 μg fluoride in up to 10 mg plutonium was developed. The interference from plutonium in the determination of fluoride by zirconium–Eriochrome Cyanine R was eliminated by reduction of the plutonium to the tripositive oxidation state with mercaptoacetic acid. The sulfate ion interferes, but relatively large amounts of iron(III), nickel, and cobalt can be tolerated.
Author (NSA)

N69-15358*# Rensselaer Polytechnic Inst., Troy, N. Y.
A STUDY OF THE EFFECT OF SURFACES ON OXYGEN ATOM RECOMBINATION AT LOW PRESSURES Technical Status Report No. 3, 1 May–31 Oct. 1968
P. Hartock, R. R. Reeves, Jr., and K. Loomis 31 Oct. 1968 7 p
(Grant NGR-33-018-086; RPI Proj. 441.22)
(NASA-CR-99002) Avail: CFSTI CSCL 07D

The study of O-atom recombination on various metal surfaces as applied to satellite mass spectrometer measurements is presented. Results at this time are in the 10^{-6}, 10^{-5} torr pressure range and lower, mainly with gas mixtures of O_2, O-atoms, Ar and small amounts of NO. The results indicated that no metal studied was totally inert to atom recombination. A recombination coefficient, γ, of somewhat less than 10^{-4} was obtained for the glass reaction vessel after conditioning the surface. Particular attention has been given to gold and a recombination coefficient of 3×10^{-3} was found. Titanium was found to be very catalytic ($\gamma > 0.05$); and aluminum relatively passive, although the activity for each metal depended on a number of variables.
Author

N69-15365# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CARBOTHERMIC SYNTHESIS OF A MIXED URANIUM–PLUTONIUM NITRIDE
W. O. Greenhalgh and E. T. Weber Aug. 1968 12 p refs Presented at Am. Chem. Soc. Meeting, Atlantic City
(Contract AT(45-1)-1830)
(BNWL-SA-1866; CONF-680918-1) Avail: CFSTI

The synthesis of a solid-solution uranium–plutonium nitride from a mixture of uranium dioxide, plutonium dioxide, and carbon in an atmosphere of nitrogen is described. The general reaction $0.80\ UO_2 + 0.20\ PuO_2 + 2\ C(s) + 1/2\ N_2(g) \rightleftharpoons (U_{0.80}Pu_{0.20})N + 2CO(g)$ was carried out at 1600°C with a brief test of completeness at 1700°C. Carbon was added in slight excess to increase the ratio of conversion and, following synthesis, steps were taken to remove the excess. The carbothermic reaction was carried out in a particle-bed reactor under a continuous and constant nitrogen flowrate. Kinetics for the reaction under synthesis conditions were followed by monitoring the reaction offgas for carbon monoxide. Rate constants at several temperatures between 1430 and 1625°C were determined. Total reaction time for a 50 gram batch was about 4 to 5 hours with approximately 99.6% of the oxide being reduced.
Author (NSA)

N69-15368 Princeton Univ., N. J.
PRECISION MOESSBAUER MEASUREMENTS OF THE THERMAL SHIFT OF A LAYERED SOLID
David Elmer Earls (Ph.D. Thesis) 1967 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-8920

An extremely precise spectrometer gave Mössbauer thermal shift and efficiency (in f) measurements on anhydrous ferric chloride over the range 83° to 350°K. The thermal shift data provide an extrapolated 0°K isomeric shift of ±0.926 ± 0.001 mm/sec with respect to sodium nitroprusside at 23°C. Detailed analysis of the in f data which are most sensitive to intermolecular vibrations results in an effective Debye temperature of 250°K. Similar treatment of the thermal shift results gives 390°K. Comparison of Mössbauer and heat capacity data indicates that iron atoms do not participate in the vibration modes that are most likely to cause large anharmonic effects on the heat capacity. A phase transition from hexagonal close-packed to face-centered cubic near 350°K was postulated and confirmed by X-ray powder diffraction. Comparison of the Mössbauer results from ferric chloride with those from ferrous chloride indicates that the Fe–Cl bonds are stronger in the ferrous compound.
Dissert. Abstr.

N69-15390# Brookhaven National Lab., Upton, N. Y.
KINETICS OF THE RADIATION-THERMAL DECOMPOSITION OF NO_2 IN FLOW
G. V. Nichipor Sep. 1968 11 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz.-Tekhn. Navuk (Minsk), no. 4, 1967 p 29–34
(BNL-Tr-223) Avail: CFSTI

Simplified equations of energy and mass transfer are given for the kinetics of chemical reactions in one dimensional flow. An attempt is made to describe the kinetics of the radiation-thermal decomposition of NO_2 in one dimensional flow. Eight differential equations of the first order are derived for the time distribution of the mixture components, and the rate constants k_i of the different reactions are tabulated.
NSA

N69-15403 Columbia Univ., New York.
THE CHARACTERIZATION AND ELECTRONIC STRUCTURES OF SOME FOUR AND FIVE COORDINATE NICKEL COMPLEXES
Benjamin Burton Chastain (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-8569

A number of diamagnetic nickel complexes with substituted phosphine ligands are discussed. Dicyanobisphosphine complexes of nickel(II) have the *trans*-planar structure, while dicyanotrisphosphine and dibromotrisphosphine complexes have the *trans*-trigonalbipyramidal structure. Tetrakisphosphine complexes of nickel(0), palladium(0), and copper (I) have the tetrahedral structure. Self-consistent charge and configuration molecular orbital calculations are reported on dicyanotrisphosphine-nickel(II0 and dibromotrisphosphinenickel(II) trigonal-bipyramidal systems and on a tetrakisphosphinenickel(0) tetrahedral system. Spectral studies of nickel(II)-cyanide systems and pentacyanocabaltate(II) are reported, and thermodynamic parameters for the tetracyano-pentacyanonic lelate equilibrium are calculated.
Dissert. Abstr.

N69-15405# Idaho Nuclear Corp., Idaho Falls.
ANALYTICAL CHEMISTRY BRANCH Annual Report, Period Ending 30 Jun. 1968
Sep. 1968 225 p refs
(Contract AT(10-1)-1230)
(IN-1203) Avail: CFSTI

Results of continuing research are reported in the areas of analytical development, classical methods, spectroscopy, spectrochemical analysis, standards and quality control, umpire qualification program, burnup determination of nuclear fuels, and LOFT-ECCS Support Program.
NSA

N69-15423# Brookhaven National Lab., Upton, N. Y. Information Div.
NEUTRON RESONANCES OF THE GADOLINIUM ISOTOPES
E. N. Karzhavina et al Aug. 1968 27 p refs Transl. into ENGLISH of Russian Rept. Jinr-P3-3882
(BNL-TR-222; JINR-P3-3882) Avail: CFSTI

The transmission and yield of γ rays from the neutron capture for ^{152}Gd, ^{154}Gd, ^{155}Gd, ^{156}Gd, ^{157}Gd, ^{158}Gd, ^{160}Gd isotopes were measured with the help of a neutron spectrometer. The parameters of the neutron resonances were determined, and some average characteristics of the Gd isotope nuclei were calculated.
Author (NSA)

N69-15436# Midwest Research Inst., Kansas City, Mo.
A STUDY OF THE ELECTRIC DEFLECTION OF MOLECULAR BEAMS
Frank T. Greene and Thomas A. Milne Aug. 1968 33 p refs
(Contract AF 49(638)-1724)
(AD-677330; AFOSR-68-1879) Avail: CFSTI CSCL 7/4

A classical electric deflection apparatus, incorporating ultra-high vacuum technology and mass spectrometric detection, has proven to operate satisfactorily in tests with Na, K, and NaCl species. An ion counting system for use with modulated beams is operational. Attempts to operate a bakeable tuning fork, to permit time-of-flight velocity distribution analysis, have been hampered by mechanical problems connected with the bakeout requirement. An examination of Hall and Zorns recent results, however, indicates that with our ability to operate the entire beam system at 1 x 10 to the -8th power torr or less, it may not be necessary to perform velocity selected experiments. Computer data reduction schemes for polarizable nonpolar molecules and for linear molecules with dipole moments and polarizability are in use. The power of universal detection is illustrated by the first measurements of the polarizability of Na2 and Na2Cl2. The latter shows an unexplained, large polarizability, at least raising the question of the validity of simple ionic models for such species. Author (TAB)

N69-15460# European Co. for the Chemical Processing of Irradiated Fuels, Mol (Belgium).
RECOVERY OF PURE PLUTONIUM BY EXTRACTION WITH TRILAURYLAMINE AND "DIRECT PRECIPITATION"
Jacobus Nicolaas Cornelis Van Geel (Ph.D. Thesis—Tech. Hogeschool, Delft, Neth.) Jan. 1968 119 p refs
(ETR-188; NP-17553) Avail: CFSTI

A new method for the purification and recovery of Pu, using selective extraction of Pu by tridodecylamine, and precipitation of Pu from the extract as plutonium oxalate is described. The results of continuous liquid-liquid extraction experiments are presented. Methods for improving the decontamination from Ru are discussed. A systematic study of the precipitation of Pu from the organic extract by means of oxalic acid is also presented. From this study, optimum precipitation conditions, resulting in minimum losses of Pu in the mother liquor, are deduced. The influence of certain process variables on the sedimentation characteristics of the precipitate is also discussed. From the data and results, a final flow sheet for the purification and concentration of Pu is proposed. NSA

N69-15462# Bettis Atomic Power Lab., Pittsburgh, Pa.
SEMIQUANTITATIVE ANALYSIS OF UNKNOWN SAMPLES BY X-RAY FLUORESCENCE SPECTROGRAPHY
T. F. Anater Sep. 1968 26 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-321) Avail: CFSTI

A method is presented for X-ray spectrographic, semiquantitative analysis of unknown samples for 27 elements commonly encountered at Bettis Atomic Power Laboratory. The method uses normalization factors, which render the major elemental peaks proportional in height to the weight concentration of the elements in the sample. This method is unique in that it requires no standards or standard curves, and any combination of the 27 elements at any detectable concentrations can be determined irrespective of sample form or geometry. This procedure is nondestructive in the special sense that it does not require alteration of the sample in any way even before analysis. A factor of two is claimed for the accuracy of the method, although the great majority of the data are within ±20% (relative). Elements below atomic number 13 (Al) cannot be detected. Physical size is the only other limiting aspect. Author (NSA)

N69-15470# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ON THE MECHANISM OF THE ELECTROPHILE AROMATIC SUBSTITUTION OF GROUPS OTHER THAN HYDROGEN [BEITRAG ZUM MECHANISMUS DER ELEKTROPHILEN AROMATISCHEN SUBSTITUTION ANDERER GRUPPEN ALS WASSERSTOFF]
Paul Bernhard Fischer (Ph.D. Thesis) 1968 80 p refs In GERMAN *Its* Dissertation No. 4071
Avail: CFSTI

The reaction time constants of halogen substitution by diazonium ions were determined in aqueous media. It was found that the time decreases analogous with the cation stability of iodine to chlorine. When bromine was substituted, a catalysis due to thiosulfate was observed, and it was shown that the thiosulfate already affects the bromine in the intermediate phase, thereby accelerating the next phase of the substitution. A marked pH dependence was noted in the study of the decomposition mechanism of 1,1'-methylene-di-2-naphtol-6-sulfo acid by diazonium ions. The azo coupling of 2-naphtol-1-sulfo acids occurs via two intermediate products which can be isolated and whose yield depends on the acidity of the solution. The structure of these products was spectroscopically studied. The products yielded by the σ complex of the 2-naphtol-1-sulfo acid coupling in a strongly alkaline medium undergo a complete structural change in the process. Also studied was the reaction of the π complex of 2-naphtol-1-sulfo acid couplings to azo dye in aprotic organic solvents and the isomerization of sulfo groups during the production of 2-naphtol-1-sulfo acid. K.W.

N69-15483# Atomic Energy Commission, Washington, D. C. Div. of Technical Information.
EXPERIMENTAL INVESTIGATION OF REACTIONS BETWEEN URANIUM DIOXIDE AND WATER UNDER NONISOTHERMAL, QUASI-ISOBARIC CONDITIONS
N. Heuzel and A. Kleine-Tebbe Nov. 1968 44 p refs Transl. into ENGLISH from Battelle Inst. e.V. rept.
(AEC-tr-6960) Avail: CFSTI

In supplementation of an isothermal investigation of chemical reactions between nuclear fuels and air or water vapor, the chemical and physical behavior of the UO_2 toward liquid water is examined under nonisothermal, quasi-isobaric conditions. Author (NSA)

N69-15506# Northwestern Univ., Evanston, Ill.
ULTRAVIOLET AND INFRARED SPECTRA OF FREE RADICALS IN IRRADIATED POLYETHYLENE
Malcolm Dole and G. G. A. Boehm 19 Jan. 1968 19 p refs Presented at the Conf. on Radiation Chem., Argonne, Ill.
(Contract AT(11-1)-1088)
(COO-1088-29; CONF-680808) Avail: CFSTI

The ultraviolet and infrared spectra of free radicals in irradiated polyethylene are discussed and compared with theoretical expectations and with observations of others. Author (NSA)

N69-15515# Columbia Univ., New York. Dept. of Chemistry.
SEPARATION OF ISOTOPES Annual Progress Report
M. R. Ghate, J. C. Goldfrank, Jessie G. Smith, J. Garbazevich, V. G. Saltamach et al 20 Sep. 1968 287 p refs
(Contract AT(30-1)-755)
(CU-755-5) Avail: CFSTI

Research progress on separation of isotopes is summarized. Topics covered include: production of ^{14}N highly depleted in ^{15}N, concentrating deuterium in a dual temperature system, mass spectrometric determination of deuterium in water, ^{15}N exchange between nitric oxide and nitric acid, and separation and analysis of isotopic species by low temperature gas chromatography. Separate abstracts were prepared for three sections. NSA

N69-15523 Pennsylvania Univ., Philadelphia.
A PHYSICO-CHEMICAL STUDY OF THE SILICON–SILICON AND THE SILICON–PHENYL BONDS
Frederic M. Rabel (Ph.D. Thesis) 1967 306 p
Avail: Univ. Microfilms: HC $13.95/Microfilm $3.95 Order No. 68-4608

This investigation was carried out in order to gain further information concerning the nature of the bonding in silicon–silicon and silicon–phenyl compounds. Necessary data were obtained by performing the following experiments: (1) The ^1H NMR spectra of $(CH_3)_3Si\text{-}Si(CH_3)_2X$ and $(CH_3)_3SiX$ (X = F; Cl; Br; I; H; O; NH; CN; N_3) were obtained at infinite dilution. (2) The ultraviolet absorption spectra of $(Ch_3)_3Si(C_6H_5)$, $(CH_3)_3SiCH_2(C_6H_5)$, and $(CH_3)_3SiCH_2CH_2(C_6H_5)$ were obtained. A detailed computer analysed ^1H NMR study of the C_6H_5-groups in $(CH_3)_3Si(C_6H_5)$ and $(CH_3)_3SiCH_2(C_6H_5)$ was undertaken. A high resolution ^1H NMR spectrum of $(CH_3)_3SiCH_2CH_2(C_6H_5)$ was also obtained. (3) The reaction of SiF_2 with cyclohexene and CH_3CN was undertaken in order to see if the nature of the reaction products could indicate whether a species such as $F_2Si\text{-}SiF_2$ were present.
Dissert. Abstr.

N69-15537 Minnesota Univ., Minneapolis.
STEADY-STATE AND NON-STEADY-STATE VOLTAMMETRIC STUDIES WITH THE ROTATING RING-DISK ELECTRODE
Duane Theodor Napp (Ph.D. Thesis) 1967 260 p
Avail: Univ. Microfilms: HC $11.70/Microfilm $3.35 Order No. 68-7421

Various steady-state and non-steady state electrode reactions were studied through the use of the rotating ring-disc electrode. A multipurpose instrument, constructed from operational amplifiers, was developed for the simultaneous and independent potentiostatic control of the ring and disc electrode. The anodic and cathodic reactions of a platinum electrode were studied in 0.1 M perchloric acid supporting electrolyte. Through the use of the ring electrode, relatively small amounts of soluble electroactive species, produced at the disc electrode during these processes, were identified. One species is Pt(II), which is produced when an oxidized platinum electrode is reduced and appears simultaneously with a characteristic reduction peak (+0.7 to +0.3 volts vs. S.C.E.) of the platinum electrode.
Dissert. Abstr.

N69-15579 Wisconsin Univ., Madison.
AN INVESTIGATION OF THE DYNAMICS OF A HOLLOW CATHODE DISCHARGE BY ANALYSIS OF THE He 2 λ 4686 A LINE
Henry Gordon Berry (Ph.D. Thesis) 1967 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 67-16892

Experiments were made observing the He II, n = 3-4, 4686 Å line complex in a cooled hollow cathode helium discharge using both a three etalon and a two etalon as spectrometers. The spectrum and ^{198}Hg calibration fringes were recorded simultaneously on a dual-channel recorder and on punched paper tape. The spectra of ^3He and ^4He were decomposed and deconvoluted by computer analysis. By varying the hollow cathode discharge conditions for the two isotopes, this study explains the origin and the effects of the drift shift. The shift is shown to be due to a drift of the ions in a small residual electric field within the hollow cathode plasma. Results are obtained for the positions of the fine structure components, the Lamb shifts, and isotope shift of ^3He and ^4He. These agree with the theoretical quantum electrodynamic values to within the accuracy of the experiment (± 1.0mK).
Dissert. Abstr.

N69-15583# Technische Hochschule Munchen (West Germany).
STEREO SPECIFIC SYNTHESIS OF CYCLOHEXANAMINO POLYOLES WITH PARTICIPATION OF ADJUNCT GROUPS IN CASE OF NUCLEOPHYLE SUBSTITUTION REACTIONS ON THE CYLOHEXANE RING [STEREOSPEZIFISCHE SYNTHESE VON CYCLOHEXANAMINOPOLYOLEN DURCH NACHBARGRUPPENBETEILIGUNG BEI NUCLEOPHILEN SUBSTITUTIONSREAKTIONEN AM CYCLOHEXANRING]
Peter Heidegger (Ph.D. Thesis) 1968 82 p refs In GERMAN
Avail: CFSTI

The effects of adjunct AcO-5 and HO-3 groups in nucleophitic substitution reactions on cyclohexane rings were studied quantitatively in order to establish reaction parameters that insure the formation of only one isomer. Stereochemical acetolysis of monobromcyclohexane required AcO-5 adjacent group participation in conformation with diaxial position of acetoxydegroup and of bromine atom. Nuclear magnetic resonance analysis on bromide position showed that only the acetyl-N-bromide 7 possessed the desired conformation, but not the NH-bromide 6 and the NH/OH-bromide 5.
Transl. by G.G.

N69-15588# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RESEARCH AND DEVELOPMENT ACTIVITIES FIXATION OF RADIOACTIVE RESIDUES Quarterly Progress Report, Feb.–Apr. 1968
A. M. Platt, ed. Sep. 1968 26 p refs
(Contract AT(45-1)-1830)
(BNWL-824) Avail: CFSTI

Approximately 3,000,000 Ci of radioactivity were successfully processed in two phosphate glass runs in WSEP. These runs represent the fourth and fifth conversion of highly radioactive wastes into glass on an engineering scale. Phosphate glass Run PG-4 was made using sulfate-containing Purex Waste 2 (PW-2) feed while PG-5 was made using sulfate-free Purex Waste 1 (PW-1) feed. Leach rates on phosphate glass solids from WSEP were 1×10^{-8} to 2×10^{-7} g/cm^2/day. Platinum corrosion was evaluated for sulfate-free phosphate glass flowsheets made with excessive phosphate, lead, and silicone antifoam agent. Significant platinum corrosion occurred only in the vapor phase with high phosphate feed and in the melt phase with feed containing lead. There was no evidence of cracking or embrittlement. Testing of low-salt flowsheets was carried out on the developmental spray solidifier. Major characteristics were a reduced capacity in the calciner, reduced denitration of the powder from spray calciner, and increased difficulty in removing the calcined powder from the spray calciner filters. Batch discharge of the melt from the melter allows filling an unheated container. A simulated spray-solidified melt prepared from low-salt PW-4 solution corroded both 304-L and 310 stainless steel at a rate of about 15 mils/month in 100 hr tests at 800°C.
Author (NSA)

N69-15606 Illinois Univ., Urbana.
THE ANALYTICAL UTILITY OF THE MERCURY FILM ELECTRODE
James Allan Cox (Ph.D. Thesis) 1967 118 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-8041

A method is described for the preparation of mercury film electrodes of uniform and reproducible thickness. The anodic stripping chronopotentiometry of the platinum-mercury system indicates that these metals combine in a reaction which consumes an appreciable amount of the free mercury available on the surface to act as the electrode. By allowing a layer of the platinum-mercury compound to form, selectively removing the excess mercury, and then depositing a known amount of mercury by constant current electrolysis, a mercury film of known, calculable thickness can be obtained. The mercury exists in the form of droplets on the

electrode following the electrolysis, but by applying a large, negative potential, these can be coalesced into a uniform film. The compound appears to be more readily wet by mercury than is platinum resulting in a more adherent film. Electrodes prepared as described can be rotated without loss of hydrogen overvoltage and have no geometric limitations. Dissert. Abstr.

N69-15611 Pennsylvania Univ., Philadelphia. Graduate School of Arts and Sciences.

APPLICATIONS OF NUMERICAL METHODS IN THE SOLUTION OF PROBLEMS IN THE STATISTICAL MECHANICS OF POLYMER SYSTEMS

Robert Frank Hoffman (Ph.D. Thesis) 1967 421 p

Avail: Univ. Microfilms: HC $19.15/Microfilm $5.40 Order No. 68-9206

Three related problems on the statistical mechanics of polymer systems are solved using numerical methods on a digital computer. First, the probability density function of the radius of gyration for the ideal, random flight chain was computed using a novel, indirect integration method. The chain expansion ratio α, which represents the increase in dimensions of a polymer chain over the random flight chain dimensions, was calculated over a range of thermodynamic parameters. The average thermodynamic properties of an adsorbed polymer were computed by extension of the polymer adsorption theory of Forsman and Hughes. When the amount of adsorbed polymer increases to a high level, and a uniform coverage model is used, there are indications that two possible density distributions can result. One of these is the "tailed" distribution previously mentioned, while the second consists of a uniform or simple Gaussian density distribution. Computations were also performed for a simpler, two step, uniform density model in which energy contour diagrams could be drawn to show the nature of the phase space. Dissert. Abstr.

N69-15612 Clemson Coll., S. C.

MATHEMATICAL SIMULATION FOR THE DIFFUSION OF WATER VAPOR AND DEUTERIUM OXIDE VAPOR IN POLYMERS

Peter Jawad Ashy (Ph.D. Thesis) 1967 138 p

Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-9017

The objective of this investigation has been to identify and quantitatively evaluate the contribution of properties that determine the sorption and diffusion processes. In particular, it was a theoretical study in which methods were developed for analyzing transient sorption data for gases in polymer films exhibiting "Fickian" and "non-Fickian" behaviors. Subsequently the method was applied to data previously obtained for the sorption of water vapor and deuterium oxide vapor in partially hydrolyzed poly (vinyl acetate). The data were analyzed to obtain diffusion coefficients by two different methods. One of these methods is applicable for constant diffusion coefficient and constant surface concentration of the penetrant. Using the complete solution of the diffusion equation at long times near the attainment of equilibrium, this method could be applied to systems where the time effects are reduced. The second method assumes a constant diffusion coefficient and a surface concentration which approaches the equilibrium values asymptotically. Dissert. Abstr.

N69-15637# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

FAST FLUX TEST FACILITY CHEMICAL ANALYSIS LABORATORY PRELIMINARY DESIGN STUDY

F. A. Scott, J. F. Jarosch, and G. B. Barton Aug. 1968 128 p refs

(Contract AT(45-1)-1830)

(BNWL-821) Avail: CFSTI

Results are presented of a preliminary design study scoped to identify the analytical chemistry needs anticipated for support of Fast Flux Test Facility (FFTF) operations, survey the current technology that pertains to those needs, select promising analytical methods, specify the facilities needed for application of these methods, and delineate areas of analytical technology that need further research and development to assure that the FFTF analytical requirements will be fully satisfied. The equipment and procedures described do not represent final selections for use, but are representative of the present state-of-the-art. The components are described and safety considerations are discussed. A state-of-the-art review is presented for determination of oxygen, carbon, hydrogen, and nitrogen, and for sample dissolution, chemical separations, spectrophotometric determinations, emission spectrographic determinations, radiochemical determinations, unshielded sodium analysis, and maintenance. NSA

N69-15642# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INVESTIGATION OF STRUCTURE OF FERROCENE AND FERRICYANIUM BY MEANS OF X-RAY K-ABSORPTION SPECTRA

E. Ye. Vaynshteyn et al 21 Dec. 1967 10 p refs Transl. into ENGLISH from Nachn. Zap.: Odessk. Gos. Ped. Inst., Kafedry Mate. Fiz. i Estestvozn. (Odessa), v. 25, no. 2, 1961 p 59-64

(AD-678471; FTD-HT-23-1190-67) Avail: CFSTI CSCL 7/4

An x-ray spectrograph with quartz crystal (1340 planes) was USED TO INVESTIGATE THE K absorption edge of iron in Fe(C5H5)2 and Fe(C5H5)2Cl. The calculation of the absorption edge was carried out under the assumption that the system is hydrogen-like. The influence of the electric field of the molecule on the hydrogen-like system is disclosed, and the effective charge of the iron ion in the investigated compound is found to be +0.7. Author (TAB)

N69-15658# Technische Hochschule Munchen (West Germany).

ON THE SYNTHESIS OF DIENES WITH HETERODIENOPHILES [BEITRAG ZUR DIENSYNTHESE MIT HETERODIENOPHILEN]

Udo Wagner (Ph.D. Thesis) 1968 71 p refs In GERMAN

Avail: CFSTI

Several thiazine derivatives and their oxygenation and hydrolysis products were examined, and their constitution was determined by means of chemical analysis and NMR-spectroscopy. The work was conducted in the course of the diene synthesis of substituted dienes with N-sulfinyl-p-toluolsulfonamide. Depending on the reaction temperature, the diene synthesis with 1-methylbutadienes and 1-phenylbutadienes results in 3- and 6-substituted adducts which proved to be stereomer pairs. In a second study, the diene synthesis with N-trichloroethylide-p-toluolsulfonamide and reacting dienes led to a number of piperidine derivatives whose constitution was identified by NMR-spectroscopy. Depending on type and position of the substituents, the bromination of the adducts results in monobromides and dibromides. The reaction of the adducts, and in one case the reaction of the bromination product, with alkali results in a number of pyridine derivatives; their structure was determined by IR, NMR, and mass spectroscopy. A reaction mechanism is suggested. Transl. by K.W.

N69-15688# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF BINARY OXIDES OF URANIUM AND RARE-EARTH ELEMENTS

G. G. Koshcheyev et al 15 Dec. 1967 7 p refs Transl. into ENGLISH from Moscow Univ. Vest. Ser. 2, Khim. (Moscow), no. 6, 1965 p 53-56

(AD-678435; FTD-HT-23-1261-67) Avail: CFSTI CSCL 7/4

The formation of fluorite-type phases was investigated in R2O3-U3O8-O2 systems (where R-La, Sm, Dy, Yb) annealed for 66-86 hr at 1200C, and the solubility limits of the rare earth

oxides in uranium octoxide were determined. The U(VI) content and the total uranium content were determined by coulometric analysis at a controlled potential. X-ray phase analysis was carried out by using the powder method with RKD-57 and RKU-86 cameras. The degree of oxidation of uranium changes with the ratio R/U and reaches 6 in samples where R/U =2/1. Thus, the presence of a rare earth oxide increases the stability of the hexavalent state of uranium at high temperatures. Contrary to expectations, the solubility of rare earth oxides in U3O8 was found to be very low (less than 1.5 mol % of RO1.5). Author (TAB)

N69-15725# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
SPECTROGRAPHIC DETERMINATION OF SILICON IN URANIUM AND IN TRICARBONATE OF AMMONIA AND URANYL [DETERMINATION ESPECTROGRAFICA DE SILICIO EN URANIO Y TRICARBONATO DE AMONIO Y URANILO]
O. O. Guido and C. B. Amaya 1968 18 p refs In SPANISH
(CNEA-219) Avail: CFSTI

Silicon volatility in impure uranium oxides was investigated using the carrier techniques of fraction distillation. Gallium oxide and fluorides of metal alkalines were recovered. Spectrographic determinations of the combination and sensitivity of the silicon in gallium oxide and lithium fluoride are also described. The determination of the effectiveness of lithium fluoride as a carrier, using the new method of analysis, compared favorably with the relative spectrographic standard of 15%. The range of concentration for silicon in the experiment was from 5 to 200 p.p.m. Author

N69-15731# Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
THE SEPARATION OF DEUTERIUM BY CONTINUOUS COLUMN USING THE H-2 HYDROGEN DIOXIDE ISOTOPIC EXCHANGE [LA SEPARATION DU DEUTERIUM PAR COLONNES CONTINUES UTILISANT L'ECHANGE ISOTOPIQUE H-2 H-2 O]
Victor Mercea 1968 23 p refs In FRENCH
(IFA-IS-52) Avail: CFSTI

The isotopic exchange reaction between hydrogen and water was considered for the separation of deuterium. The principles of the method are outlined and the experimental results obtained from various studies are compiled to show the limitations of the method. An elementary process was considered combining the H_2–H_2O isotopic exchange reaction with distillation of the water in order to obtain continuous separation columns. The principle of the method is outlined, and the experimental verification of the theory was summarized. A separation scheme utilizing complete phase conversion was also studied. The experimental installation for the study of this method of isotopic separation was described. The use of a dual-temperature system for the separation of deuterium was also tested on a pilot installation. The experimental results confirmed the theoretical calculations and showed the possibility of using the dual-temperature methods for deuterium production. The application of these methods to heavy-water cooled reactors and to other problems of isotopic separation is considered. NSA

N69-15741# United Kingdom Atomic Energy Authority, Harwell (England). Metallurgy Div.
COMPENDIUM OF REFERENCES TO STUDIES OF THE PROPERTIES OF LIQUID METAL BINARY SYSTEMS WHICH RELATE TO THEIR STRUCTURE
B. W. Mott Jul. 1968 47 p refs
(AERE-Bib-151-A) Avail: CFSTI/HMSO: 7s

A listing of 132 liquid metal binary systems is included in the bibliography. The physical properties of the binary system discussed are indicated for each listing. NSA

N69-15748*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ACOUSTIC RELAXATION AND PROPAGATION RATE OF HYPERSONIC WAVES IN LIQUIDS
G. G. Sukhotina et al 1968 6 p refs Transl. into ENGLISH from Vestn. Mosk. Univ. (Moscow), no. 1, 1966 p 9–12
(Contract NAS7-100)
(NASA-CR-99107) Avail: CFSTI CSCL 07D

The parameters of acoustic relaxation for several organic liquids were calculated at 20°. Measurements of hypersonic velocity were performed in decane, cyclohexane, decaline, ortho- and p-xylene, styrol, nitromethane, acetonitrile, tri- and tetrachloroethylene. Values of the hypersonic velocity (V_r) and hypersonic frequency were calculated; the quantity V_r was determined to an accuracy of 2 to 4% (as a function of the ratio between the intensities of the central and marginal components of the Rayleigh triplet). B.P.

N69-15754#
ROLE OF SURFACE WAVES IN SPIN WAVE RESONANCE IN FILMS
V. M. Sokolov et al [1968] 8 p refs Transl. into ENGLISH from Fiz. Tverd. Tela (Leningrad), v. 10, no. 6, 1968 p 1793–1799
Avail: CFSTI

A spin wave spectrum is found for the most general kind of boundary conditions on the basis of a solution of the Landau-Lifshits equation. Because of the boundedness of the film under general boundary conditions, hyperbolic, in addition to harmonic, solutions occur which, in the limiting case of large thicknesses, go over into surface waves. It is shown that the principal peak in the spin wave resonance spectrum in a thin ferromagnetic film, which is ordinarily classified as a homogeneous ferromagnetic resonance peak, apparently corresponds to excitation of surface oscillation modes. Author

N69-15765 Arizona State Univ., Tempe.
A STUDY OF SOME ELECTRICAL PROPERTIES OF ERBIUM OXIDE
Amrita Lal Bhattacharyya (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-6798

Electrical conductivity of ceramic erbium oxide in the temperature range of 450°C to 1425°C has been extensively studied at oxygen pressures between 10 to 10^{-6} atm. The same has been studied for a single crystal of erbium oxide between 900°C to 1400°C and in the same pressure range as above. At high temperatures the conductivity behaviour of the single crystal specimen is found to be the same as those of the ceramic ones. Electrical conductivity increases with temperature as well as with oxygen pressure, the latter property indicating p-type behaviour. The thermoelectric power Q of ceramic erbium oxide measured in the above pressure range and between 700°C to 1400°C has a positive sign, thus agreeing with the observed p-type behaviour of conductivity measurements. At high temperatures Q decreases slowly with temperature and increases with decreasing oxygen pressure. Dissert. Abstr.

N69-15787# United Kingdom Atomic Energy Authority, Windscale (England). Production Group.
ANALYTICAL METHOD FOR THE DETERMINATION OF RUTHENIUM 106, RUTHENIUM 103, ZIRCONIUM 95, NIOBIUM 95, CERIUM 144 AND CESIUM 137 IN PLUTONIUM DIOXIDE
1968 6 p
(PG-845(W)) Avail: CFSTI

A solution of PuO_2 in HF–HNO_3 containing 200 to 300 mg/ml Pu was scanned using a Li-drifted germanium detector and a 400-channel spectrum analyzer. The distintegration rates of the six isotopes were determined by a photopeak integration technique. Author (NSA)

N69-15807# Argonne National Lab., Ill.
CHEMICAL ENGINEERING DIVISION. Semiannual Report, Jul.–Dec. 1967
May 1968 197 p refs (Contract W-31-109-eng-38)
(ANL-7425) Avail: CFSTI

Developments in research programs are presented. Included are: (1) a description of the CHEMLOC-2 computer program for calculating extent of metal–water reaction, core heating, and core motion; (2) laboratory investigations on fluorination of UO_2–PuO_2 fission products; (3) current status of investigation of neutron capture cross sections of reactor materials; (4) determination of burnup of fast reactor fuels by photometric titration; (5) compact pyrochemical processes; (6) energy conversion systems; and (7) chemical studies of irradiated ceramic fuels. F.O.S.

N69-15813# Oak Ridge National Lab., Tenn.
REVIEW OF ISOTOPES TARGET PROGRAM, JANUARY 1965–DECEMBER 1967
E. H. Kobisk Oct. 1968 37 p refs
(Contract W-7405-eng-26)
(ORNL-4308) Avail: CFSTI

The reduction-distillation of metals and van Arkel–de Boer purification of isotopes methods of preparing high purity isotopic materials are described. The vacuum evaporation technology of self supporting films of bismuth, germanium, manganese, and silicon is discussed and methods presented. The new radioisotope facility is described. The preparation of targets for the High Energy Neutron Reaction Experiment (HENRE) is outlined. Target preparation methods for 72 elements with the resulting thicknesses are included. NSA

N69-15842# Interior Dept., Washington, D. C. Library.
MECHANISM OF THE THERMIC REDUCTION BY MAGNESIUM AND FORMATION OF TITANIUM-SPONGE IN COMMERCIAL REACTORS
E. E. Lukashenko et al [1968] 8 p Transl. into ENGLISH from Titan i Ego Splavy, Akad. Nauk SSSR, Inst. Met. (Moscow), no. 6, 1961 p 14–20
(PB-179634T) Avail: CFSTI CSCL 07A

Six trials were made to study the mechanism of the thermic reduction by magnesium and formation of titanium sponge in the commercial apparatus with the inserted reaction beaker. The location and shape of the reaction bulk (substance) in the beaker were examined, as well as the composition of the reaction substance and the quality of the sponge during the reduction by introduction of about 20, 30, 60, 80, and 95 percent of the amount of TiCl4 used during the usual cycle of reduction. A short review of existing opinions about the mechanism of magnesium reduction of TiCl4 was made. Author (USGRDR)

N69-15902*# National Aeronautics and Space Administration, Washington, D. C.
THERMAL DECOMPOSITION OF LEAD CARBONATE PELLETS [SEIKEI SHITA TANSA ' EN NO NETSUBUN SOKUDO]
R. Komoda, Y. Nishi, and M. Kano Jul. 1968 17 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Toyko), v. 71, no. 4, 1968 p 475–479 Presented at the 32nd Ann. Conf. of the Chem. Eng. Soc., Apr. 1967
(NASA-TT-F-11857) Avail: CFSTI CSCL 07D

Investigation of the rate of thermal decomposition of a sample of lead carbonate packed in a glass cylinder was carried out using a thermobalance and the influence of the process of dispersion of the carbon dioxide gas produced on the rate of thermal decomposition was analyzed quantitatively. The thermal decomposition temperature was 230° to 260° C in stage I, 300° to 380° C in stage II. The flow rate of nitrogen gas was 0.04 to 1.5 l/min. Stage I: $2\,PbCO_3 \rightarrow PbO \cdot PbCO_3 + CO_2$; Stage II: $PbO \cdot PbCO_3 \rightarrow 2PbO$ (resurge) $+ CO_2$. The relationships of the rate of decomposition (F) to time (t) are expressed for each stage. Author

N69-15915# Tracerlab, Inc., Richmond, Calif.
RADIOCHEMICAL ANALYSES OF PLUTONIUM-238 DIOXIDE COLLECTED ON IMPACTORS M-15, M-37, M-22, AND M-32
W. D. Holland Albuquerque, N. Mex. Sandia Corp. Jun. 1968 36 p refs Sponsored by AEC Prepared for Sandia Corp.
(SC-CR-68-3073) Avail: CFSTI

Radiochemical analyses were performed to inventory the ^{238}Pu collected on impactors M-15, M-37, M-22, and M-32 from arc tunnel tests of SNAP fuel particles simulating reentry. The results were combined with individual particle measurements, obtained by the hollow-star and electronic-counting techniques, to calculate the percentage of the total amount of Pu that was collected as particles with equivalent $^{238}PuO_2$ diameters smaller than 0.1 μ. In addition the weight percentage of radioactive particles in the larger size ranges collected on each impact was determined. Author (NSA)

N69-15935# IIT Research Inst., Chicago, Ill.
FEASIBILITY STUDY OF THE DEVELOPMENT OF A SPECIALIZED COMPUTER SYSTEM OF ORGANIC CHEMICAL SIGNATURES OF SPECTRAL DATA Progress Report, 17 Oct. 1967–16 Jan. 1968
R. G. Scholz, E. S. Schwartz, and M. E. Williams 16 Feb. 1968 62 p refs
(Contract NSF C-514)
(IITRI-C6104-3; PB-178354) Avail: CFSTI CSCL 05B

The objective of the project is to determine the feasibility of identifying an unknown compound by screening it against a file of spectral data of known compounds. The chemical signatures are obtained from infrared spectrometry, nuclear magnetic resonance, mass spectrometry, gas chromatography, and ultraviolet (UV) spectrophotometry. Data for 500 representative pure organic compounds are being used to develop the system. The logic and the procedures of an experimental system based on spectral data for the 500 compounds are designed for ready conversion to a computer. The work encompasses selecting and acquiring source data; analyzing, indexing, and cataloging the data; preparing the data for retrieval; devising a file structure and search strategy; and demonstrating feasibility through operation of a data-matching and -screening system in which optical coincidence in an inverted file is used to establish a match. Author (USGRDR)

N69-15941# Princeton Univ., N. J.
ELECTRICAL CONDUCTIVITY CHANGES DURING HETEROGENEOUS CATALYSIS. A STUDY OF THE INTERFACIAL POLARIZATION OF A POWDERED ZINC OXIDE BY AUDIO FREQUENCY RELAXATION MEASUREMENTS DURING THE CATALYTIC OXIDATION OF CARBON MONOXIDE
Jerome V. Connoy and Peter Mark Oct. 1968 106 p refs
(Contract N00014-67-A-0151)
(AD-678384; ONR-TR-1) Avail: CFSTI CSCL 7/4

The electrical conductivity changes of an industrial, powdered zinc oxide catalyst during the chemisorption and catalytic oxidation of carbon monoxide in an isothermal tubular reactor were derived from a study of interfacial polarization by a dispersion analysis of audio frequency relaxation measurements in situ at conditions of temperature (100C - 350C) and pressure (5 p.s.i.g.) encountered in industrial process systems. The conductivity changes observed during carbon monoxide oxidation are consistent with both the equilibrium conversion of oxygen as a function of residence time, and the Arrhenius dependence of the oxidation rate constant.

Although a conductivity-activity correlation has not yet been quantitatively established, owing to instrumentation limitations, the asymptotic behavior of oxygen conversion as a function of residence time indicates the existence of such a correlation. Author (TAB)

N69-15942# Naval Research Lab., Washington, D. C.
EFFECT OF SOLUBILIZED METHANOL ON MICELLE SIZE IN A NONPOLAR SOLVENT
Albert J. Fryar and Samuel Kaufman 27 Sep. 1968 17 p refs
(AD-678364; NRL-6763) Avail: CFSTI CSCL 7/4

The behavior and state of aggregation of barium dinonylnaphthalene sulfonate in toluene, toluene-methanol and methanol solutions were studied by ultracentrifugation and viscometry. The aggregation number of its micelles is substantially reduced at free methanol mole fractions of 0.03 and less. In pure methanol, micelles do not exist, and the monomers dissociate ionically. Results of the investigation supplement an earlier observation that the solubilization of methanol diminishes the size of sulfonate and carboxylate micelles in nonaqueous solvents. Author (TAB)

N69-15943# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
STRUCTURE OF LIQUIDS. Final Report
Roy Kaplow and B. L. Averbach Sep. 1968 6 p refs
(Contract Nonr-1841(48))
(AD-678410; DSR-7954) Avail: CFSTI CSCL 7/4

The results of the authors research on liquid structures, have been summarized from their ten publications listed in the bibliography. These cover technical aspects of the experiments, developments in the analytic techniques, the measurement of the distribution functions for a number of pure and alloy liquids and for some of the corresponding solids, and the interpretation of these data within the framework of statistical mechanical and structural models. This summary considers a number of separate aspects of the research, mentioning the major points which have been presented in detail in the publications. Author (TAB)

N69-15972# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
BIBLIOGRAPHIC DISCUSSION OF THE PHYSICO-CHEMICAL BEHAVIOR AND THE RADIOECOLOGY OF RUTHENIUM IN HYDROBIOLOGICAL SYSTEMS [DISCUSSION BIBLIOGRAPHIQUE SUR LE COMPORTMENT PHYSICO-CHIMIQUE ET LA RADIOECOLOGIE DU RUTHENIUM DANS LES SYSTEMES HYDROBIOLOGIQUES]
Robert Bittel Jul. 1968 66 p refs In FRENCH
(CEA-BIB-123; EUR-3863.f) Avail: Issuing Activity

Investigations relating to the behavior of radionuclides with a complex physico-chemistry, and whose fate in the hydrological systems can vary according to the combinations in which they are included were divided into two parts. The first part dealt especially with the physico-chemical aspects of Ru. It was a monograph of the classical characteristics of the ruthenium compounds and particularly of those, saline or complex, that interfere with radio-chemical and radio-ecological problems (compounds of nitrosyl-ruthenium, tetraoxyde, etc.). The analytical aspect had special stress on the methods and techniques of separation and concentration of ruthenium and identification of different species of ruthenium (particularly the physical methods as for example the infrared spectrometry). The second part examined the behavior of ruthenium in water, aquatic organisms, or in soils. Determination of the sensitive or critical ways of transfer of ruthenium to the aquatic food chain was attempted. NSA

N69-16048# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
HIGH TEMPERATURE PYROLYSIS OF AMMONIUM PERCHLORATE [PYROLYSE A HAUTE TEMPERATURE DU PERCHLORATE D'AMMONIUM]
Jean-Francois Lieberherr 1968 18 p refs Presented at the 12th Intern. Symp. on the Combust., Poitiers, France, 14-20 Jul. 1968 Submitted for publication
(ONERA-TP-812) Avail: CFSTI

Experiments extending the temperature domain of the ammonium perchlorate linear pyrolysis studies were performed by a method derived from the porous plate technique but using instead an electrically heated grid. The temperature domain extended from 590°K to 1540°K and the pressure domain from 0.026 to 26 atm. In the most interesting domain, above 910°K the results are well represented by an empirical relation which expresses a dependency of the regression rate upon the pressure. The pressure sensitivity depends upon the surface temperature and reciprocally. Below 21 atm, at a given pressure, the regression rate seems to increase with increasing temperature, whereas it decreases above 21 atm. The concept of free pyrolysis (adiabatic) is introduced, as opposed to force pyrolysis (diabatic). Ordinary combustion under pressure can be assimilated to a free pyrolysis. The agreement between the free pyrolysis data and the burning rate data is excellent. The burning rate or free pyrolysis rate is then proportional to the 0.5^{th} power of pressure at low pressures (1 to 5 atm) and to the 0.9^{th} power at high pressures. At low temperatures the regression rate is not sensitive to pressure. Author (ESRO)

N69-16062# Brookhaven National Lab., Upton, N. Y.
SOLUTIONS OF HALOGENS IN MOLTEN HALIDES
John D. Van Norman and Richard J. Tivers Aug. 1968 20 p refs Presented at Symp. on Characterization and Anal. in Molten Salts at the Am. Chem. Soc. Meeting, Atlantic City, 9-11 Sep. 1968 Sponsored by AEC
(BNL-12810; CONF-680918-3) Avail: CFSTI

The solubility of chlorine in molten lead chloride, silver chloride, and the lithium chloride-potassium chloride eutectic and the solubility of bromine in molten lead bromide and lithium bromide were determined. It was found that chlorine becomes more soluble in molten chlorides as the temperature increases while the reverse is true for bromine in molten bromides. Thus, the heats of solution for the chlorine-chloride systems are positive while those of the bromine-bromide systems are negative. The solubilities of bromine in the molten bromides are an order of magnitude greater than those of the chlorine-chloride system. An impermeable vitreous carbon electrode was successfully used for chronopotentiometric measurements on the chlorine-chloride systems The diffusion coefficients so determined are an order of magnitude larger than those generally associated with ions in molten salts. Author (NSA)

N69-16063*# National Aeronautics and Space Administration, Washington, D. C.
DIAPHRAMS FOR ELECTROLYSIS: PARTS 2 AND 3 [DENKAIYO KAKU MAKU NI KAN SURU KENKYU (DAI 2-3 PO)]
Takeo Matsuno Sep. 1968 15 p refs Transl. into ENGLISH from Kogyo Kagaku Zasshi (Tokyo), v. 52, 1949 p 281-284
(NASA-TT-F-11846) Avail: CFSTI CSCL 07D

The average differences between the length of ion passage through randomly spaced and sized diaphram holes and the actual thickness of the asbestos diaphram were investigated. The diaphragm is placed in a known concentration of electrolyte solution and its electrical resistance is measured. From the measurement and theoretical calculation of the resistance, the value of α (resistance observed/resistance calculated) was 2 to 3, meaning that the effective length of capillary passage is 2 to 3 times the thickness of diaphram. The value of α is about constant regardless of the

type, material, or other properties of the diaphram. The influences of the electrolysis solution or medium on the effective space occupied by the holes of the diaphram were also investigated. The density of the diaphram materials in various solvents was measured, and the differences which resulted between density and apparent effective hole ratio were due to the inability of solvents to penetrate microholes. B.P.

N69-16067# Japan Atomic Energy Research Inst., Tokyo.
REMOVAL OF RADIOACTIVE IODINE VAPOR WITH ION-EXCHANGER
Sigehisa Iwai et al [1968] 22 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi, Tokyo, May 1967
(NSJ-TR-117) Avail: CFSTI

The use of ion exchange materials for the removal of radioactive iodine from air streams is investigated. Experiments were carried out with ion exchange resin, liquid ion exchangers and other materials to evaluate the removal efficiency and factors affecting the removal. A packed column of Amberlite-IRA-400-OH showed a high exchange absorption capacity for gaseous iodine. The rate of iodine transport from air stream to resin phase and the rate of ion exchange were estimated to be sufficiently high. A larger decontamination factor for radioiodine (3.5×10^3) was obtained with the Amberlite column than with either activated charcoal, copper balls, or molecular sieves under conditions of identical pressure loss. The presence of 50% CO_2 in the air stream provided little interference with the exchange ability of Amberlite due to the large mass action constant between I^- and CO_3. Tris(2-ethylhexyl)amine showed smaller removal efficiency than solutions of either silver nitrate, sodium hydroxide, or sodium thiosulfate under conditions of identical volume and concentration. Author (NSA)

N69-16069# Andrews Univ., Berrien Springs, Mich.
MECHANICAL PROPERTIES OF SEPARATED METALLIC ISOTOPES Final Report
Donald D. Snyder 16 Sep. 1968 97 p refs
(Contract AT(11-1)-972)
(COO-972-12) Avail: CFSTI

Mechanical properties of enriched isotopes of Li are determined. Measurements made include: bulk densities, the electrical resistivities, melting points, thermoelectric power, infrared absorption, the elastic modulus, and lattice spacing. Measurements were made for ^6Li, ^7Li, and natural Li. Procedures and results are described. NSA

N69-16084# California Univ., Riverside. Dept. of Chemistry.
THE FORMATION OF CARBAPENTABORANE AND ITS 1-METHYL DERIVATIVE FROM 1,7-CARBAHEXABORANE
Gary B. Dunks and M. Frederick Hawthorne 10 Oct. 1968 9 p refs
(Contract N00014-67-A-0353)
(AD-678373; TR-8) Avail: CFSTI CSCL 7/2

The reaction of 1,7-dicarbaclosooctaborane with $(CH_3)_4NBH_4$ produces ionic products which are, in turn, converted to a mixture of lower carboranes. In this manner the parent unsubstituted $C_2B_5H_9$ carborane was obtained in approximately 20% yield. This reaction sequence affords the first example of the extrusion of a single carbon atom from a two-carbon carborane. Author (TAB)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-15029 Technische Hochschule München (West Germany).
A NEW AUTOMATIC AND BROAD BAND IMPEDANCE MEASUREMENT PROCESS IN THE AREA OF MICROWAVES [EIN NEUES AUTOMATISCHES UND BREITBANDIGES IMPEDANZMESSVERFAHREN IM MIKROWELLENBEREICH]
Wolfgang Berghofer (Ph.D. Thesis) [1968] 21 p refs in GERMAN
Avail: CFSTI

The method described here is based on the transformation to an intermediate frequency for the sake of simplicity. The transmitter is equipped with a carcinotron or a voltage-tunable magnetron and has a doubly swept frequency, one sweep with a slow, large phase amplitude, the other with a fast, small sawtooth amplitude. Two signals are fed to a mixer: one from the transmitter via a delay line, the other directly or via the measured object. Because of the fast sawtooth frequency modulation, the frequency of the transmitter changes by a constant value while the wave travels in the delay line. This constant value is exactly the amount of the intermediate frequency obtained in the mixer, and the intermediate frequency represents the impedance that was sought by the measurements, i.e., its value, phase, and its linear mixing. K.W.

N69-15039# General Atronics Corp., Philadelphia, Pa.
SPIRAL SCAN PROJECTION SYSTEM Final Report
Robert C. Hilliard and Don N. Thomson 30 Mar. 1968 49 p
(Contract DA-36-034-AMC-0181)
(AD-674261; GAC-1710-2009-5) Avail: CFSTI CSCL 17/2

The report describes a CRT Projection System for projecting a spiral scan onto a portion of an elliptical screen. The object is to provide the operator with a panoramic display. Author (TAB)

N69-15056 Houston Univ., Texas.
REALIZATION OF OPTIMUM ORTHOGONAL MULTIPLEXING SYSTEMS
Thomas Williams, Jr. (Ph.D. Thesis) 1967 133 p
Avail: Univ. Microfilms; HC $6.40/Microfilm $3.00 Order No. 68-7860

Orthogonal functions were analyzed, and mathematical relationships were derived for message distortion due to time, frequency, and amplitude truncation. The orthomux system was also simulated on an IBM 7090 digital computer. The real exponential sets of orthogonal functions are proposed as the most easily realizable from the standpoint of equipment simplicity. The bandwidth of the real exponential set is comparable with that required for frequency division multiplexing for a system with ten or fewer channels and one percent distortion. Functions based on powers of t are included because these can be readily generated using operational amplifiers. Digital orthogonal functions having a peak-to-average power ratio of unity are also discussed because of their desirability for use in a communication system which is part of a larger digital system. System implementation and performance improvement techniques generally applicable to orthomux systems are presented. Dissert. Abstr.

N69-15067 Maryland Univ., College Park.
PROPAGATION OF RADIO WAVES OVER ICE WITH UNDERLYING SEA WATER

Ahmad Haji Firouzabadi (Ph.D. Thesis) 1967 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-6524

The general problem of ground wave propagation over a two-layer medium whose properties vary in one particular direction is discussed. The analysis considers in detail the specific problem of ground wave propagation over sea ice with the underlying sea water. The problem is analyzed theoretically by using Maxwells field equations and satisfying the appropriate conditions imposed by the various boundaries. A general expression for ground wave attenuation is obtained and it is indicated that the well known numerical results for the homogeneous ground can also be employed for the ground wave propagation in this particular case of two layers, by proper definition of an "effective numerical distance," an "apparent conductivity," and an "apparent permittivity." A number of curves relating the ground wave attenuation and effective numerical distance for various temperatures, thicknesses of ice, and frequencies are obtained from which the electric field strength can be obtained readily. Dissert. Abstr.

N69-15085# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN DEMANDS ON THE OPTICAL FREQUENCY RECIEVERS IN COMMUNICATION SYSTEMS USING COHERENT LIGHT
Ch'en Heng 16 Nov. 1967 16 p refs Transl. into ENGLISH from Wu Hsien Tien Chi Shu, no. 11, 1965 p 12-17
(AD-674349; FTD-HT-23-606-67) Avail: CFSTI CSCL 17/2

The development of the laser as a coherent, excellent monochromatic and highly directional optical signal source has led to its possible application in optical communication. The object of this paper is to set forth some special requirements of light demodulators for coherent light optical communication. light demodulators operate in a manner similar to radio receivers, except that they require the conversion of light input to photocurrent and their noise has strong quantum characteristics. General requirements for light demodulators are high sensitivity and a high signal to noise ratio. In an optical communication system, the preferred modulation frequencies and band widths are in the infra-red range and higher. Some semiconductors are promising for use in demodulators operating in the infra-red range, but they do not completely fulfill the other requirements. Among light detection methods that can be used, optical heterodyning appears to be of particular importance. Author

N69-15124 Johns Hopkins Univ., Baltimore, Md.
THE OPTIMUM DESIGN OF LINEAR NONUNIFORMLY SPACED ARRAYS
Richard Paul Dooley (Ph.D. Thesis) 1967 96 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-6554

Details are given on the development and application of an efficient computational algorithm for determining the optimum design of linear nonuniformly spaced antenna arrays. The resulting design is optimum in the sense that, for a specified pair of parameters N and k, the location p(u) of the equally excited antenna elements is such that the radiation pattern function P(u) has the smallest possible sidelobe level. The parameter k is defined as the ratio of the maximum period of P(u) to the beamwidth of P(u) and N is the number of elements. The computational algorithm makes possible a search technique, specifically tailored to this problem, which is suitable for use with a modern high speed digital computer. Author

N69-15126 Johns Hopkins Univ., Baltimore, Md.
PROPERTIES OF NON-GAUSSIAN, CONTINUOUS PARAMETER, RANDOM PROCESSES AS USED IN DETECTION THEORY
Percy Anthony Pierre (Ph.D. Thesis) 1967 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-6573

Representations of continuous parameter random processes are presented in terms of denumerable sequences of uncorrelated random variables. The basic problem is to determine whether these uncorrelated random variables are also independent for certain classes of non-Gaussian processes. Certain non-Gaussian processes and their relationship to Gaussian processes are studied. Such properties as sample continuity and total variation are considered. The quadratic variation of random processes is discussed. Some known results for Gaussian processes and independent increments processes are extended to non-Gaussian processes and certain integrals of independent increments processes respectively. Conditions which imply the singularity or non-singularity of signal detection problems are investigated. Non-Gaussian, noise-like signals are also studied. It is found that the second order conditions which determine singularity in the Gaussian case also determine singularity for a certain class of non-Gaussian processes. Dissert. Abstr.

N69-15143 Wisconsin Univ., Madison.
MULTIPATH AND DOPPLER SPREAD OF A TRANSHORIZON TROPOSCATTER LINK
Ordean Sherman Anderson (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-5276

A study was conducted on the multipath and Doppler spreading effects on a transhorizon tropospheric scatter link between Arlington, Wisconsin and Cedar Rapids, Iowa. The important results are: (1) The multipath and Doppler spread parameters computed using the characterization of the troposcatter channel as a quasi-wide-sense stationary uncorrelated scattering channel with Gaussian statistics produce multipath and Doppler spread parameters which compare very well with values measured during turbulent atmospheric conditions. (2) The multipath and Doppler spread pair can be measured and used to characterize the scattering structure if the cross-path wind is known. (3) The Doppler spread is linearly dependent on mean cross-path wind under similar atmospheric conditions. (4) The Doppler spread measured using the envelope technique exhibits a strong dependence on antenna pointing angle, i.e., the Doppler spread increases when the antennas are pointed away from the great circle. Thus an antenna alignment technique is proposed utilizing this property of the Doppler spread. Dissert. Abstr.

N69-15147 Ohio State Univ., Columbus.
THE USE OF HIGHER NYQUIST RATE FREQUENCY CHARACTERISTICS TO INCREASE THE CAPACITY OF DIGITAL DATA TRANSMISSION SYSTEMS
Joseph Mahler (Ph.D. Thesis) 1967 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-8852

Consideration is given to the effect on channel capacity to using higher Nyquist rate pulses, a technique that now appears practical because of the advent of efficient channel equalization by use of active transversal filters. Such improved equalization is necessary not only to permit use of a greater fraction of the assigned bandwidth but also because the frequency characteristics of the higher Nyquist rate pulses have more uniform energy density over their bandwidth and, hence, are more sensitive to poor equalization at the band edges. It is also anticipated that essentially dispersionless channels created by use of synchronous demodulation of frequency division multiplexed signals in a wide band channel will be available shortly. A raised-cosine shape with different amounts of relative roll-off was used as the standard frequency characteristic for the study, which was made for Nyquist rates of W, 1.2W, 1.5W, 1.75W, and 2W. The time domain waveforms associated with them were obtained by digital computer integration and plotting. These plots and supplementary analysis provided the essential data used. Dissert. Abstr.

N69-15190 State Univ. of Iowa, Iowa City.
DETECTABILITY OF MARKOV DEPENDENT BERNOULLI SIGNALS IN GAUSSIAN NOISE
Milo Michael Hruby (Ph.D. Thesis) 1967 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-5959

In this study, through the use of the concepts of statistical decision theory, is contrived a decision rule, called the adaptive decision rule, which is germane to the detection of Markov dependent signals perturbed by Gaussian noise. Correlation of observations on the stochastic process consisting of the linear addition of noise with the output of a discrete, ergodic Markov source is attributable to both, the Markov dependence of the source signal and to the correlation caused by dependence among noise samples. A strategy is devised which allows a decision to be made regarding the true state of nature of the source during a particular time interval, based on an observation taken at some instant of time within the interval. A derivation of the conditional error probabilities is provided, from which, knowing the costs assigned to each type of error, an expression for the average risk is obtained. Also, an expression is given for the percentage of time that it is necessary to resort to the previous observation in making a decision. Dissert. Abstr.

N69-15209# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF BROADBAND MINIATURE ANTENNAS
Andrew Durham Harris and Glen A. Myers Sep. 1968 37 p refs
(AD-677320; NPS-52MV8091A) Avail: CFSTI CSCL 9/5

The report considers the application of a negative impedance converter to a short monopole antenna. The theory of short antennas and an analysis of TH_2 negative impedance converter are presented. The frequency-response characteristics of the negative impedance converter are analyzed. The performance of each of various miniature antenna configurations is compared experimentally with that of a 16 foot untuned whip antenna. The nonlinear behavior of the negative impedance converter is explored experimentally. Also considered is the manner in which atmospheric noise level influences the design of antennas intended to operate in the frequency region below the VHF band. Author (TAB)

N69-15304 Michigan Univ., Ann Arbor.
OPTIMAL SPACE-TIME SIGNAL PROCESSING AND PARAMETER ESTIMATION WITH EMPHASIS ON ITS APPLICATION TO DIRECTION FINDING
Donald Gene Mueller (Ph.D. Thesis) 1967 228 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-7677

Techniques are developed for processing signals received by a spacial array of K omnidirectional antennas so as to produce optimal direction-of-arrival estimates. Two distinct approaches to the problem are pursued which apply differing mathematical disciplines. The first approach models the array as an element of a phased array direction finding system and attempts to apply "Stochastic Optimal Control Theory" to produce optimal control laws for directing the pointing angle and specifying the beam width of the array. Optimal filtering of the signals is also considered. The controls and filter which result in "Minimum Error Variance" are considered optimal. The second approach applies "Estimation Theory" and considers the array only as an information gathering device whose signals are to be processed directly without the "prefiltering" present in phased arrays. The optimality criterion of this approach requires the direction-of-arrival estimate to result in a "Minimum Probability of Error" or, what is shown to be equivalent, to have "Maximum a Posteriori Probability." Dissert. Abstr.

N69-15316*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ELECTROMAGNETIC INTERFERENCE ASPECTS OF INTEGRATING A UHF/VHF RECEIVER ONBOARD MARINER 5
Richard K. Cass and Louis H. Keeler 1 Nov. 1968 37 p refs
(Contract NAS7-100)
(NASA-CR-99004; JPL-TR-32-1315) Avail: CFSTI CSCL 22B

On a spacecraft, electronic equipment in close proximity must operate in the environment of noise generated by every other device on that spacecraft. When the electronic equipment is a sensitive radio receiver, the spacecraft noise can affect the sensitivity of the receiver if the noise is in its passband. The tasks involved in the integration of a dual frequency receiver (DFR) on Mariner V as part of the complement of scientific instruments are discussed. The primary effort was that of ensuring proper experiment operation after it was determined that noise contributed by the spacecraft was excessive at 49.8 MHz and that there was an interaction of the DFR 423.3-MHz channel with the S-band telecommunications ranging system. The criteria for verifying proper system operation and the modifications necessary for establishing a compatible spacecraft environment are discussed. Author

N69-15362*# Techtran Corp., Glen Burnie, Md.
TEN YEARS OF INTERNATIONAL COOPERATION IN THE DOMAIN OF OPTICAL TRACKING OF ARTIFICIAL EARTH SATELLITES [10 LET MEZHDUNARODNOGO SOTRUDNICHESTVA V OBLASTI OPTICHESKIKH NABLYUDENIY ISKUSSTVENNYKH SPUTNIKOV ZEMLI]
A. G. Masevich et al Washington NASA Jan. 1969 12 p refs Transl. into ENGLISH from Byul. St. Optich. Nablyudeniya Iskusstv. Sputnikov Zemli (USSR), no. 6, 1967 p 5-11
(Contract NASw-1695)
(NASA-TT-F-12076) Avail: CFSTI CSCL 17H

A decade of international co eration in the domain of optical tracking of satellites is summarized. The history of the organization of optical tracking of satellites in the USSR and associate countries and the development of international cooperation in the domain of scientific investigations based on such observations are briefly described. Some of the basic instruments used in optical and photometric tracking of satellites are also described. Author

N69-15373*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
EXAMPLES OF CODING SCHEMES BASED ON STRATEGIC VALUE
W. W. Happ Washington NASA Jan. 1969 18 p refs
(NASA-TN-D-4962) Avail: CFSTI CSCL 09D

Procedures are developed to construct variable-length codes for alphabets containing messages with assigned weighted-information content. Criteria specifying the strategic value of a code are defined, and codes are examined on the basis of alphabets containing messages with weighted-information content. Figures-of-merit are established and utilized to compare different types and possible trade-offs for simple codes. Algorithms governing these codes are established and examined on the basis of representative examples. Author

N69-15404 Syracuse Univ., N. Y.
ITERATIVE ALGORITHM FOR REAL TIME CONTROL SIGNAL SYNTHESIS FOR A GENERAL CLASS OF TRACKING PROBLEMS
Moshe Krieger (Ph.D. Thesis) 1967 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-7774

The computational complexity of the general tracking problem is reduced by two modifications to make real time synthesis feasible. First the look ahead time interval over which the desired system response is specified, is divided into N equal time intervals and in one iteration the control signal is synthesized for the first

subinterval only. Also, the dimensionality of the problem is reduced by assuming the desired system response is specified only for a subspace of the system state space. It is shown that the solution of this modified tracking problem, when obtained using ordinary calculus, can be divided into two steps. The first step can be precomputed once and for all for a given system and the second, involving direct control signal synthesis, becomes an iterative procedure with relatively small computational requirements. This procedure is tested by way of examples, and it is shown that excellent results are obtained with few operations, thus proving that real time solution of the tracking problem is feasible. Dissert. Abstr.

N69-15408*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DIGITAL DEMODULATION WITH DATA SUBCARRIER TRACKING
David K. Sanger 1 Aug. 1968 24 p refs
(Contract NAS7-100)
(NASA-CR-99054; JPL-TR-32-1314) Avail: CFSTI CSCL 09F

The concept of digital telemetry demodulation depends upon a computer algorithm to accomplish bit synchronization be testing the incoming data stream over intervals that are one-third of a bit time early and one-third of a bit time late with respect to the estimated data transition time. Correct bit synchronization results when the estimated timing intervals have been adjusted properly. This early-late bit timing scheme coupled with a Costas data tracking loop is the basis for the digital demodulator discussed in this report. Author

N69-15420*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COMPARISON OF C-BAND, SECOR AND TRANET WITH A COLLOCATED LASER ON 10 TRACKS OF GEOS-2
John H. Berbert and Horace C. Parker (RCA Serv. Co.) Nov. 1968 73 p refs
(NASA-TM-X-63431; X-514-68-458) Avail: CFSTI CSCL 17

As part of the GEOS Observation Systems Intercomparison Investigation, NASA Laser, Army SECOR, and Navy TRANET tracking systems were moved to the NASA Wallops Island station and located near C-band radars. Simultaneous tracking of GEOS 2 by all systems was accomplished during April, May, and June, 1968 to enable comparisons of the tracking data freed from the effects of uncertainties in survey, gravity field, and systems time synchronization. Reference orbits were determined from the laser data. Comparison of tracking data from the radio tracking systems with the laser reference orbits yielded residuals from which zero-set and timing biases were derived for each system. The preliminary results for the 10 passes reported here indicate, for the SECOR, a consistent unexplained negative zero-set bias averaging about 10.8 m. The two C-band radars generally agree with the laser to within ±5 meters. The TRANET data have an average positive bias of about 16.6 cm/sec, which has been mostly explained by a procedure peculiar to the preparation of GEOS (and ANNA) data for the Geodetic Satellite Data Service (GSDS). Author

N69-15438# RAND Corp., Santa Monica, Calif.
SINGULAR NON-GAUSSIAN MEASURES IN DETECTION AND ESTIMATION THEORY
Percy A. Pierre Oct. 1968 30 p refs
(AD-677365; P-3954) Avail: CFSTI CSCL 9/4

If a mathematical model of a signal detection problem is such that there exists a detector which achieves zero error, the model is called singular. Such models are usually not acceptable. In this paper, we present various sufficient conditions for singular detection and estimation. For the case of a known signal, second moment conditions are given which imply singularity of detection in the most general kind of noise. For the case of random signals, no such general result exists. Author (TAB)

N69-15531# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
ADAPTIVE DETECTION RECEIVERS AND REPRODUCING DENSITIES
Theodore G. Birdsall Jul. 1968 47 p refs
(Contract Nonr-1224(36))
(AD-677466; TR-194; REPT-3674-17-T) Avail: CFSTI CSCL 9/4

The design of detection equipment that can learn for itself the values of necessary constants (parameters) unknown to the designer or user has been the recent goal of theoretical research. The theory developed to date required the designer to specify the a priori distribution of the uncertain parameters. This paper points out a physically important property: the likelihood ratio of observation may be obtained in a two-step process. The observed input is first processed through a receiver section designed on the basis of a simple mathematically tractable a priori distribution. This is the major bulk of the processing. The output of this first section is a small handful of numbers (sufficient statistics) which are then used in calculation of the likelihood ratio for the users chosen a priori function. The output of this second computation section is then compared to a threshold to obtain a terminal yes-no decision. Thus the major design work can proceed without knowledge of the actual statistical distribution to be used. Author (TAB)

N69-15573 Clemson Coll., S. C.
AN INVESTIGATION OF THE EXTENSION OF KALMAN FILTER THEORY TO THE ESTIMATION OF STOCHASTIC SIGNALS
Lee Stephen Miller (Ph.D. Thesis) 1967 115 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-9022

The objective of this study is the development of a sequential estimation theory applicable to cases in which the input to a linear system is a correlated stochastic process. The analysis is related to the following problems: 1) Estimation of a communications signal which arrives via a time-varying channel containing additive noise. 2) Estimation of the driving function of a control system for which noise contaminated observations of only the state vector are available. Both discrete-time and continuous-time systems are considered. The signal is assumed to be a first-order vector Markoff process; the state variable is thus a second-order vector Markoff process. Multivariate solutions, for the minimum-variance estimation filter, are developed based upon an a priori signal estimate. An a posteriori signal estimate is then obtained using two successive values of the observable state vector. The solutions comprise discrete and continuous filter algorithms for estimating a second-order vector Markoff state variable. Dissert. Abstr.

N69-15608 California Univ., Los Angeles.
AN ADAPTIVE REMOTE TELEVISION SYSTEM
Alvin Harris Miller (Ph.D. Thesis) 1968 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-8780

An adaptive communication system, designed for the transmission of television pictures over interplanetary distances, is proposed. The system is designed to provide an efficient utilization of existing channel information rate capacity and a low symbol error rate by adapting its operating parameters in response to variations in channel conditions and picture characteristics. The basic system is controlled by providing a feedback link from the receiver, where the arriving signal is processed and analyzed, back to the remote transmitter. The adaptation of the system is done in response to the decisions made at the receiver concerning the noise conditions of the channel, the characteristics of the television picture, and the error statistics of the received signal. The basic information-theoretical considerations for the transmission of pictorial information are considered along with the electronic systems aspects. Dissert. Abstr.

N69-15610 Syracuse Univ., N. Y.
SCATTERING CROSS SECTION OF A LOADED CIRCULAR METALLIC LOOP
Joseph Leslie Ryerson (Ph.D. Thesis) 1967 75 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-5487

The bistatic scattering cross section of a thin metallic circular loop is determined by both variational and integral equation methods. This loop is loaded with any number of admittances connected between closely spaced terminals at chosen positions around its circumference. Formula for the cross section of the loop per square wavelength of the incident radiation are obtained as Fourier series. These formula are functions of the coordinates of transmitter and receiver, location of the load gap, load admittances, angles of incidence and polarization loop radius and wire radius and the wavelength. It is demonstrated that these general formula may be specialized to formula previously derived in the literature for the monostatic cross section of the unloaded circular metallic loop. Solutions for scattering cross section are obtained from the evaluation of the short circuit admittance parameters of a multi-port consisting of the transmitter and receiver antenna and the load gaps of the scattering loop. Dissert. Abstr.

N69-15651# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
INVESTIGATION OF PARTIALLY REFLECTED ECHOES FROM THE D-REGION OF THE IONOSPHERE
A. R. Cole 1 Dec. 1968 93 p refs
(Grants NSF GA-1456; NSF 6P-5611; Nonr-656(35))
(AD-677328; SR-328) Avail: CFSTI CSCL 20/9

An experiment designed to enable observation of weak echoes, partially reflected from scatterers in the D-region, is described. The basic theory of partial reflections, including the manner in which electron density profiles are obtained, is presented along with an examination of some of the assumptions which the theory makes. The equipment developed to perform the partial reflection experiment is described in detail. Author (TAB)

N69-15660 IIT Research Inst., Chicago, Ill.
PHASED ARRAY PATTERNS UNDER TRANSIENT CONDITIONS
Gerald Francis Saletta (Ph.D. Thesis) 1968 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-7850

A method of computing the antenna array pattern when the array is excited by bursts of sinusoids has been developed. Results valid for nondispersive feed lines are given in terms of trignometric functions. The analysis is carried out in the time domain. For dispersive feed lines a similar analysis in the time domain leads to an expression for the array pattern in terms of an integral. The integrand is the square of an infinite sum of Lommel functions. This result is not amenable to computation. Frequency domain analysis leads to an integral whose integrand is easily adapted to numerical integration techniques. The program used for the numerical integration is given in the appendix. Previous work assumes nondispersive feed lines. This work gives the array pattern for nondispersive feed lines in a more compact form than previously given and in addition gives array patterns when dispersive feed lines are used to feed the array elements. Dissert. Abstr.

N69-15668 Michigan Univ., Ann Arbor.
THEORY OF SIGNAL DETECTABILITY: EXTENSION TO THE DOUBLE COMPOSITE HYPOTHESIS SITUATION
Ronald Lee Spooner (Ph.D. Thesis) 1967 228 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-7733

The theory of signal detectability is extended to situations in which each of the two possible hypotheses are composite. The specific problem considered is that of detecting signals mixed with noise for examples in which uncertainties exist in both the signal and noise processes. The uncertain process parameters are considered to be both time invariant and time varying during the detection interval. The approach to the detection problem is Bayesian and the initial uncertainties concerning the signal and noise processes are expressed in terms of a priori probability distributions. The time of a terminal decision is not assumed to be specified prior to the observation interval. A general optimum processor for the doubly composite detection situation is developed. This processor is based on the overall optimal qualities of the likelihood ratio. The operation of the receiver is realized in a sequential manner for processes in which an m-th order Markov conditional dependence relation is assumed to exist. Dissert. Abstr.

N69-15683*# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Electrical Engineering.
A SPACE COMMUNICATIONS STUDY Status Report, 15 Sep.-15 Dec. 1968
Donald L. Schilling, Kenneth K. Clarke, and Raymond L. Pickholtz 15 Dec. 1968 7 p
(Grant NGR-33-006-020)
(NASA-CR-99122) Avail: CFSTI CSCL 17B

Investigations on distortion in a frequency demodulator using feedback and modifications to a frequency locked loop are reviewed. The harmonic distortion of a frequency modulated feedback (FMFB) system was obtained using a computer. The voltage controlled oscillator and the FMD inside the loop are assumed ideal. The input signal to the FMFB is of constant amplitude and is sinusoidally modulated. The input-output relationship is given by a nonlinear differential equation. Procedures for the systematic design of an FMFB will be drawn from the distortion and spike rejection relationships. An analysis was made of the improvement to be expected from a double order quantized frequency locked loop (FLL). This loop essentially contains a "false hold" detecting circuit that prevents the basic or lower quantized FLL from holding on low amplitudes that do not correspond to clicks. Theoretical calculations were made which indicate that further improvements in threshold performance can be obtained by using such circuitry rather than a conventional discriminator or a single quantized second order loop without "false hold" detecting circuitry. B.P.

N69-15704 Texas A&M Univ., College Station.
THE RADIATION ZONE FIELDS OF THE STEPPED DIELECTRIC ROD ANTENNA EXCITED IN THE H_{11} MODE
Paul Kennedy York (Ph.D. Thesis) 1967 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-5029

Analytical expressions for the fields of the antenna are obtained by two methods. A continuous array of point sources is used as a model for the antenna which allows the field pattern of the antenna to be determined by using an empirical expression for an unknown function of the angular coordinates. This function has little effect on the pattern in the vicinity of the principle lobe. In the second method, the exact form of this function and the resulting fields of the antenna are determined from an application of an equivalence principle in which the fields on the antenna surface are assumed to be those of a forward traveling HE_{11} waveguide mode. It is found that only the equivalent currents on the lateral surfaces of the antenna need be considered, except in the case of very short antennas. When the contributions of the equivalent currents on the section ends are required, the integrals for these contributions must be evaluated numerically. The field patterns calculated from the analytical expressions are compared with experimentally determined field patterns. Dissert. Abstr.

N69-15726*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Telecommunications Div.
LARGE SPACECRAFT ANTENNA STUDY, ANALYTICAL PATTERN SUBTASK
R. M. Dickinson 15 Jan. 1969 32 p refs
(Contract NAS7-100)
(NASA-CR-99137; JPL-TR-32-1352) Avail: CFSTI CSCL 09F

Results are presented of an analytic and experimental program to develop techniques for calculating the circularly polarized patterns of erectable spacecraft high-gain antennas. Surface equations for one class of radial rib erectable antenna are derived. Mathematical expressions are developed for calculating the far field circularly polarized patterns based upon the reflector surface equations and circularly polarized feed illumination patterns. Experimental measured patterns were obtained to compare with the computer calculated theoretical patterns. Sample computer programs used to obtain the best focus position and to calculate patterns are contained in the Appendix. Author

N69-15751*# California Univ., La Jolla. Dept. of Applied Electrophysics.
PERFORMANCE OF AN IDEAL QUANTUM RECEIVER OF A COHERENT SIGNAL OF RANDOM PHASE
Carl W. Helstrom [1968] 17 p refs
(Grant NGR-05-009-079)
(NASA-CR-99049) Avail: CFSTI CSCL 17B

An ideal quantum receiver detecting a coherent narrowband optical signal in the presence of thermal background radiation is studied. Curves are given both of the average probability of error in a binary communication system transmitting 0's (blanks) and 1's (pulses) with equal probabilities, and of the probability of detection for various fixed values of the false-alarm probability. Author

N69-15803# LTV Electrosystems, Inc., Greenville, Tex.
PANORAMIC RECEIVER OPERATION IN STRONG SIGNAL ENVIRONMENTS
Dec. 1968 11 p
(G3682-02-010) Avail: Issuing Activity

In recent years, refinements in traveling wave tube and tunnel diode amplifiers, frequency selective networks employing YIG (Yttrium-Iron-Garnet) spheres, and voltage-tunable oscillators have made possible the development of high sensitivity, fast sweeping, panoramic receivers to receive far-distant or low-level signals. The ever increasing presence of pulsed transmitters operating at higher and higher peak power levels with sharp leading and trailing edges has combined with the advent of these sensitive receivers to make more difficult the effective use of this expanded receiver capability. Some of the more important receiver design parameters bearing on this situation are discussed, as are also some techniques for minimizing the effect of very high-level pulsed signals on the detection and display of low-level signals. Author

N69-15824*# National Aeronautics and Space Administration, John F. Kennedy Space Center, Cocoa Beach, Fla.
SATURN 5 UNIFIED S-BAND TRANSMITTING SYSTEM ELECTROMAGNETIC COMPATIBILITY TEST REPORT
L. D. Adams (ITT-Federal Elec. Corp.) 17 Jun. 1968 32 p ref
(NASA-TM-X-61382; TR-661) Avail: CFSTI CSCL 09F

Results are presented which were derived from the unified S-band (USB) electromagnetic compatibility (EMC) tests which were conducted on the Command and Communications System (CCS) and Command Service Module (CSM) parasitic antenna systems and transponders of the AS-501 launch vehicle in the Vehicle assembly Building (VAB). The tests were performed to locate the cause of malfunction which existed when both CCS and CSM systems were operated simultaneously. Author

N69-15840# Communication Satellite Corp., Washington, D. C.
RF TESTS ON RADOME MATERIAL
A. O. Pacholder 26 Aug. 1968 23 p refs
(CL-14-68; PB-179456) Avail: CFSTI CSCL 17I

The horn reflector antenna in Andover, Maine, which is protected by an air-supported radome, experiences a serious degradation in its G/T under rainy conditions. Water on the radome attenuates electromagnetic waves because it causes reflection, scattering, and absorption which decreases the system gain. In addition, system noise temperature increases from absorption in the wet radome and because part of the reflected and scattered energy is absorbed by the ground. A theoretical and experimental investigation of the causes of the large degradation in system G/T was conducted. Also, the possibilities of improving the performance under rainy conditions were examined. Author (USGRDR)

N69-15843# Joint Publications Research Service, Washington, D. C.
INFRARED SYSTEMS FOR DETECTION, DIRECTION FINDING AND AUTOMATIC TRACKING OF MOVING TARGETS
L. Z. Kriksunov et al 16 Dec. 1968 317 p Transl. into ENGLISH of the book "Infrakrasnyye Sistemy Obnaruzheniya, Pelengatsii i Avtomaticheskogo Soprovozhdeniya Dvizhuschikhsya Ob Yektov" Moscow, Soviet Radio Publishing House, 1968 p 1-320
(JPRS-47082) Avail: CFSTI

The theoretical working principles, schematic and structural diagrams of infrared systems are presented. Problems of thermal radiation of targets and backgrounds, the data processing procedure in infrared systems and methods of calculating their range are investigated. Basic data and characteristics are presented for infrared devices for detection, reconnaissance, direction finding and automatic tracking of moving targets. Author

N69-15865# Joint Publications Research Service, Washington, D. C.
BIBLIOGRAPHY TO NEAR EARTH AND BURIED ANTENNAS
G. A. Larov et al 13 Dec. 1968 18 p refs Transl. into ENGLISH from Russian Supplement to JPRS-41131
(JPRS-47075) Avail: CFSTI

A bibliography is presented on antenna radiation patterns transmitting over the earth and under the earth. Articles on soil conductivities and dielectric constants are also included. B.P.

N69-15869# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADAR THEORY AND TECHNIQUE (SELECTED ARTICLES)
29 Dec. 1967 43 p refs Transl. into ENGLISH from the book "Trudy. Aviatsionnyy Institut.," Moscow, 1966 p 36-54 and 97-109
(AD-678473; FTD-HT-23-1449-67) Avail: CFSTI CSCL 17/9

CONTENTS:

1. ENERGY ASPECTS OF RADAR SCANNING OF LIMITED AREAS OF THE EARTH'S SURFACE B. F. Vysotskiy et al p 1-9 (See N69-15870 05-13)

2. SIMULATION OF RANDOM NUMBERS ON AN ELECTRONIC DIGITAL COMPUTER V. A. Kikharev et al p 10-21 refs (See N69-15871 05-19)

3. EFFICIENCY OF COHERENT RADAR IN THE RECEPTION OF PARTIALLY COHERENT PACKETS I. M. Miroshnichenko p 22-36 refs (See N69-15872 05-07)

N69-15872# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFICIENCY OF COHERENT RADAR IN THE RECEPTION OF PARTIALLY COHERENT PACKETS

I. M. Miroshnichenko *In its* Radar Theory and Tech. 29 Dec. 1967 p 22-36 refs (See N69-15872 05-07)
Avail: CFSTI

Using threshold signal-to-noise ratio as an indicator of radar capability, the author compares coherent and noncoherent processing of a partially coherent radar signal and formulates requirements for stability of the phase-determining elements of coherent radar components (the transmitter, local and coherent heterodyne, and delay line). The analysis shows that the application of coherent processing for a partially coherent signal does not essentially reduce signal threshold energy. The graphs and formulas provided facilitate choice of the channel numbers and passband comb filter for various targets. Author

N69-15933# Rensselaer Polytechnic Inst., Troy, N. Y. Div. of Electrophysics.
SCATTERING OF TE(0) SUB 01 MODE ENERGY FROM A CENTERED METAL RING, WITH APPLICATION TO ANTENNA ARRAYS
John A. Bradshaw Jan. 1968 19 p refs
(Contract C-117-66)
(PB-179464; TR-EP-6801) Avail: CFSTI CSCL 20N

A variational expression for the fields scattered by a metal ring, centered in round waveguide, is obtained for excitation by circularly symmetric TE modes. An example is worked out and the method supported by application to a rectangular iris for which data are available. An antenna array for launching TE01 or TE02 fields in round waveguide is described, based on current rings, and measurements of its performance given. It is capable of launching rather pure fields in highly over-moded guide, but its efficiency is not high. Author (USGRDR)

N69-15963# Joint Publications Research Service, Washington, D. C.
PROCESSING SIGNALS WITH VARIABLE PULSE REPETITION FREQUENCY
S. V. Samsonenko 11 Dec. 1968 22 p ref Transl. into ENGLISH from the book "Tsifrovyye Metody Optimal 'Noy Obrabotki Radiolokatsionnykh Signalov" (Moscow), 1968 p 115-134
(JPRS-47055) Avail: CFSTI

Special devices, based on elements of digital computers, are described in relation to their use in automatic detection circuits for signals in radar stations with variable pulse repetition frequencies. In such devices, signal processing takes place in definite range elements. The observed detection distance R is quantized (strobed) into elemental intervals of extent ΔR. Each elementary range interval has its channel for analysis of radar information, containing a special detection system (SDS) for the detection of the desired signal from the target. This SDS processes the signal at determined elementary intervals over several pulse repetition periods of the radar. Schematics depict: (1) a strobing circuit for the elementary range elements; (2) a circuit for sequential search; (3) a circuit for sequential-parallel search; (4) a circuit for combined search; (5) the structure of the binary converter; (6) ferrite detection system for quantized packets; (7) SDS for quantized data into the counters; and (8) SDS for a number of channels equal to the number of targets. M.G.J.

N69-15999# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).
REPORT ON THE INTERIM MEETING OF THE 4TH C.C.I.R. COMMITTEE [BERICHT UEBER DIE ZWISCHENTAGUN DER CCIR-STUDIENKOMMISSION IV]
F. W. Bodemann *In its* Kleinheubacher Rept., Vol. 11 1966 p 103-106 (See N69-15984 05-13) In GERMAN Conf. held at Monte Carlo, 1965
Avail: CFSTI

The C.C.I.R. Committee formed five sub-committees responsible for the technical aspects of communication satellites, sharing problems, technical characteristics of meteorological and navigation satellites, transmission and noise and radioastronomy. Their different tasks are outlined and their recommendations presented. ESRO

N69-16007# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut für Ionosphärenphysik.
OBSERVATION OF MAGNETIC SPLITTING IN BACKSCATTERING EXPERIMENTS WITH VARIABLE FREQUENCY [BEOBACHTUNG DER MAGNETISCHEN AUFSPALTUNG BEI RUECKSTREUVERSUCHEN MIT VARIABLER FREQUENZ]
H. Stiewitt *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 147-150 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Backward diffraction of UHF waves at multiple diffraction centres in the ionosphere observed at the location of the sender furnishes diffraction distance versus frequency patterns which allow an observation of magnetic splitting, which varies with the direction of reflection, the time of the day and the seasons. It is possible to compute the backward diffraction edge in these patterns by means of the Ray Tracing Program allowing any layer profile to be considered and to compare the profile effects with experimental data. ESRO

N69-16008# Czechoslovak Academy of Sciences, Prague. Astronomical Inst.
ANALYTICAL WAVE PROPAGATION FORMULAS FOR PRACTICAL APPLICATION [ANALYTISCHE FORMELN FUER WELLENAUSBREITUNG MIT PRAKTISCHEN ANWENDUNGEN]
E. Chvojkova *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 151-153 (See N69-15984 05-13) ref In GERMAN
Avail: CFSTI

By representing the electron density for a single layer by a quasi-parabola and subdividing this layer into four zones, conditions for the wave propagation e.g. between satellite transmitters and ground stations are determined. ESRO

N69-16011# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. für Ionosphärenphysik.
ANALYSIS OF BACKSCATTERING OBSERVATIONS OF UHF WAVES BY POLAR AURORAS [ANALYSE VON RUECKSTREUBEOBACHTUNGEN ULTRAKURZER WELLEN AN POLARLICHTERN]
Peter Czechowsky *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 165-171 (See N69-15984 05-13 refs In GERMAN
Avail: CFSTI

UHF communication through reflection by polar light according to Booker's theory reaches its optimum if, at the point of reflection, the angles between the incident and the outgoing wave normals and the direction of the earth's magnetic field are equal. Between two stations at least one coincidence must occur between the reflection curve, where the above condition is satisfied, and polar light regions. The measurements reported confirm this theory as to the range of connection obtained. Extra long range connections are explained by variations in the inclination of the magnetic field due to currents in the ionospheric E-layer. ESRO

N69-16012# Geophysical Observatory, Sodankyla (Finland).
RADIO MEASUREMENTS OF POLAR AURORAS IN SODANKYLA [MESSUNGEN VON RADIONORDLICHTERN IN SODANKYLAE]
J. Oksman
In Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 173–177 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

From measurements of the field strength of 89.9 Mc/s waves received over 360 km it appeared that backscattering from polar light regions has a maximum at 16–17 hrs and a minimum at 8–9 hrs UT. It is easy to correlate this to the magnetic storms, e.g. the maximum with the positive, and the minimum with the negative deviation of H with a phase advance of the polar light echos of 2–3 hrs, which is ascribed to a migration of ionization fields at an apparent speed of 250–350 km/h. ESRO

N69-16013# Max Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. für Ionosphärenphysik.
THE INFLUENCE OF GEOMAGNETIC IRREGULARITY ON THE USABLE FREQUENCY RANGE IN LONG DISTANCE SHORT WAVE COMMUNICATIONS AT THE BOUNDARY OF THE POLAR AURORAL ZONE [EINFLUSS DER ERDMAGNETISCHEN UNRUHE AUF DEN BRAUCHBAREN FREQUENZBEREICH IM KURZWELLENWEITVERKEHR AM RANDE DER NORDLICHTZONE]
H. G. Möller and Jih-Chen Ma *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 179–184 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

From measuring the total travel times for different paths versus the frequency over 2000 km it was found that in winter nights, with increasing magnetic disturbances, the maximum observable frequency (MOF) increases in transmission towards higher latitudes; however, this is less so for the lowest observable frequency (LOF). Thus the usable frequency range is not narrowed by average magnetic disturbances, but both frequency limits are shifted towards higher values. Only at strong disturbances LOF catches up with MOF, thus interrupting communications. ESRO

N69-16021# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. für Stratosphärenphysik.
ON THE DETERMINATION OF VLF PROPAGATION PARAMETERS FROM FIELD STRENGTH MEASUREMENTS AT DISTANCES FROM 350 TO 800 KM [UEBER DIE BESTIMMUNG VON LAENGSTWELLEN AUSBREITUNGS-PARAMETERN AUS FELDSTAERKEMESSUNGEN IM INT-FERNUNGSBEREICH 350 BIS 800 KM]
J. Frisius *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 225–230 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Field strength measurements of the GBR transmitter at 8 stations on a straight line at a distance of 400 - 800 km were interpreted using a simple two-parameter ionosphere model with equivalent height h' and reflection coefficient $R = -\exp(-\alpha\cos\vartheta)$, from which h' and α were to be determined. From original discrepancies between the model and the measurements it was concluded that the parameter values must be determined separately for conditions at noon and before sunrise, it thus being possible to characterize VLF propagation conditions. ESRO

N69-16022# Bonn Univ. (West Germany). Stockert Radio Observatory.
THE DETERMINATION OF REFLECTION COEFFICIENTS OF THE D REGION IN THE VLF RANGE [DIE BESTIMMUNG VON REFLEXIONSPARAMETERN DER D-SCHICHTIM LAENGSTWELLENBEREICH]
H. Volland *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 231–235 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Using a two-paramater ionosphere model it is possible to determine the apparent reflection height h and the empiric reflection coefficient α from measurements of VLF waves at several separated stations. If a phase measurement is included, h and α can be derived from measurements at one or two stations only, which is planned for the Bonn Univ. Observatory. ESRO

N69-16023# Battelle Inst., Frankfurt am Main (West Germany).
SUNRISE EFFECTS ON THE VLF RECEPTION FIELD STRENGTH AT LARGE DISTANCES FROM THE TRANSMITTER [SONNENAUFGANGSEFFEKT DER LAENGSTWELLENEMPFANGSFELDSTAERKE BEI GROSSEN SENDERENTFERNUNGEN]
G. Ries *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 237–242 refs (See N69-15984 05-13) In GERMAN
Avail: CFSTI

VLF phase variations occurring stepwise during sunrise over the propagation path are ascribed to changes in the reflection coefficient at the successive points of reflection of an assumed 5-hop path from Panama to Frankfurt. ESRO

N69-16026# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut fuer Ionosphaerenphysik.
METEOROLOGICAL INFLUENCES ON THE SURFACE WAVE SPREADING OF A 2.78 MHz WAVE BETWEEN S. MARINELLA/ROME AND CAPO SAN LORENZO/SARDINIA [METEOROLOGISCHE EINFLUESSE AUF DIE BODENWEL-LENAUSBREITUNG EINER 2.78 MHZ-WELLE ZWISCHEN S. MARINELLA/ROM AND CAPO SAN LORENZO/SARDI-NIEN]
G. Rose and H. U. Widdel *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 253–254 In GERMAN (See N69-15984 05-13)
Avail: CFSTI

Studied were the meteorological effects on ground wave propagation at 2.78 MHz across a water surface. Wave frequency amplitude showed a minimum during February coincident with a cold wave developing on the shore. Transl. by G.G.

N69-16027# Tubingen Univ. (West Germany). Astronomical Inst.
RADIOSPECTROGRAPHY AND INTERFEROMETRY AT THE WEISSENAU OUTSTATION [RADIOSPEKTROGRAPHIE UND INTERFEROMETRIE IN DER AUSSENSTELLE WEISSENAU]
H. W. Urbarz *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 225–262 refs (See N69-15984 05-13) In GERMAN
Avail: CFSTI

The various details of a new wide band spectrograph operating from 50 to 500 Mc/s are described, viz., the mechanical construction, the antenna system, the spectroradiometer and registrating system and the two-element radio-interferometer. ESRO

N69-16028# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany). Forschungsinstitut.
CALCULATION OF THE SECONDARY MAXIMA PROPORTION IN DIFFRACTION DIAGRAMS BY MEANS OF A SIMPLE APPROXIMATION METHOD [DIE BERECHNUNG DES NEBENMAXIMAANTEILS IN BEUGUNGSDIAGRAM-MEN NACH EINEM EINFACHEN NAEHERUNGSVERFAH-REN]

G. F. Koch *In its* Kleinheubacher Rept., Vol. 11 1966 p 263–271 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

This theoretical investigation of directional antennas by approximation methods deals with the proportion of energy radiated into the secondary maxima of diffraction patterns caused by circular and rectangular apertures, proceeding from Kirchhoff's boundary values for E and H, respectively. It appears that a circular aperture causes less energy to be transmitted through the secondary maxima.
ESRO

N69-16031# Hamburg Univ. (West Germany). Meteorological Inst.
RECENT FIELD STRENGTH INVESTIGATIONS IN THE CM AND M BAND ACROSS OPEN SEA UNDER CONSIDERATION OF FADING [NEUERE FELDSTAERKEUNTERSUCHUNGEN IM CM- BIS M-BAND UEBER SEE UNTER BESONDERER BERUECKSICHTIGUNG DES FADINGS]
H. Jeske and H. D. Seehars *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 279–285 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

From field strength measurements of directional beam transmission lines over 77 km of open sea an improvement of the correlation between the received field strength and atmospheric parameters was obtained, viz., the height of the evaporation wave guide was described by an improved formula and by accounting for turbulence effects: the latter causing the short-period fading which is most marked at low field strength levels.
ESRO

N69-16032# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany). Forschungsinstitut.
REPORT ABOUT THE INTERMEDIATE CONFERENCE OF THE 5th STUDENT COMMISSION FROM THE CCIR [BERICHT UEBER DIE ZWISCHENTAGUNG DER V. STUDIENKOMMISSION DES CCIR]
J. Grosskopf *In its* Kleinheubacher Rept., Vol. 11 1966 p 287–288 In GERMAN Conf. held in Geneva, 9–22 Jun. 1965 (See N69-15984 05-13)
Avail: CFSTI

Discussed are multi-national utilization of directional frequency bands by satellite systems, wave propagation over rough surfaces, and tropospheric propagation in optical observation and scatter.
Transl. by G.G.

N69-16033# Rundfunk- und Fernsehtechnisches Zentralamt, Kolberg (East Germany).
INVESTIGATIONS OF 1.2, 8.1, AND 11 GH/Z PROPAGATION WITHIN OPTICAL SIGHT AND COMPARISON MEASUREMENTS WITH LINEAR AND CIRCULAR POLARIZATION [AUSBREITUNGSUNTERSUCHUNGEN INNERHALB DER OPTISCHEN SICHT BEI 1,2, 8,1 UND 11 GHZ SOWIE VERGLEICHENDE MESSUNGEN MIT LINEARER UND ZIRKULARER POLARISATION]
Udo Kuehn *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 289–296 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

From 12-month measurements over a distance of 82 km with linear or circular polarization it was found that both give the same transmission reliability. Marked influence on the reflection coefficient is exerted by the vegetation. Some preliminary results from measurements with 8 and 11 Gc/s to judge on transmission reliability and the possible use of frequency diversity methods are discussed.
ESRO

N69-16034# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany). Forschungsinstitut.
FREQUENCY DIVERSITY MEASUREMENTS AT 540 MN/s [FREQUENZDIVERSITY-MESSUNGEN UM 540 MHZ]
O. Schmeller *In its* Kleinheubacher Rept., Vol. 11 1966 p 297–301 (See N69-15984 05-13) In GERMAN
Avail: CFSTI

Investigations of the behavior of television wave propagation in transhorizon links showed fast, scatter-like fading in the daytime and slower fading at night. The transmitter band width is wider for a stable atmospheric condition.
ESRO

N69-16036# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany). Forschungsinst.
THE SPATIAL STRUCTURE OF THE SCATTER RECEPTION FIELD AND OF THE DIELECTRIC CONSTANT IN COMMON VOLUME AND SOME CONSEQUENCES TO SCATTER TECHNIQUE [DIE RAEUMLICHEN STRUKTUREN DES SCATTER-EMPFANGSFELDES UND DER DIELEKTRIZITAETSKONSTANTEN IM GEMEINSAMEN VOLUMEN SOWIE EINIGE FOLGERUNGEN FUER DIE SCATTERTECHNIK]
L. Fehlhaber and J. Grosskopf *In its* Kleinheubacher Rept., Vol. 11 1966 p 307–314 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

The stochastic structure of the received field strength is a function of the stochastic structure of the dielectric constant (and hence the index of refraction) in the scattering medium, whence the correlation function of one structure can be computed from the other, by considering second order terms in scatter theory. Measurements of the spatial correlation of the received field strength by means of spatially distributed antennas showed close agreement with the theory of atmospheric turbulence and also with other experimental data. The antenna to medium coupling loss has also been studied.
ESRO

N69-16037# Hamburg Univ. (West Germany). Inst. of Radio and Maritime Meteorology.
THE INFLUENCE OF REFLECTION AT INVERSIONS ON THE INCOMING SIGNAL LEVEL FOR OVER THE HORIZON LINES IN THE VHF RANGE [DER EINFLUSS DER REFLEXION AN INVERSIONEN AUF DIE EMPFANGSFELDSTAERKE BEI UEBERHORIZONTSTRECKEN IM UKW-BEREICH]
Gerda Fengler *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 315–318 refs In GERMAN (See N69-15984 05-13)
Avail: CFSTI

Receiver field strength analyses for over horizon transmission lines and comparison with tropospheric structure show that high receiver field strength is coupled to inversions, but that not each inversion produces an increase in field strength. Each transmission line possesses an optimal region with the most effective diffraction-homogeneity index. This effective region is higher for larger distances between transmitter and receiver.
Transl. by G.G.

N69-16047# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
DATA TRANSMISSION SYSTEM FOR THE SINGLE AXIS SIMULATOR
A. W. Löffler Paris ESRO Dec. 1966 9 p
(ESRO-TM-P-81-ESTEC) Avail: CFSTI

This paper describes a data transmission system planned for use in the Single Axis Simulator, using nine flexible leads but capable of transmitting four analog and twelve digital signals.
ESRO

N69-16057# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
TELEMETRY SYSTEM FOR THE SINGLE AXIS AND THREE AXIS SIMULATOR
G. L. Reijns Paris ESRO Dec. 1966 10 p
(ESRO-TM-P-83-ESTEC) Avail: CFSTI

A general description of the system and the reasons for the choice of the pulse code modulation (PCM) telemetry system, are given. This 62 input channel equipment is proposed for both the single axis and the three axis simulators intended for the investigation of attitude control problems of the actively stabilized astronomical satellite. The main characteristics of the telemetry encoding and transmitting system are also discussed. ESRO

N69-16058# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
A PROPOSED COMMUNICATION SYSTEM FOR THE L.A.S.
H. Martinides Paris ESRO Apr. 1965 32 p
(ESRO-TM-P-117(ESTEC)) Avail: CFSTI

Various factors determining the communication system of the L.A.S. are discussed (contact time, number of telemetry links, bit rate, use of the tone digital command system etc.). Figures for the power consumption and weight are given for a suggested communication system. Author (ESRO)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-15105 Purdue Univ., Lafayette, Ind.
OPTIMUM FINITE SEQUENTIAL PATTERN RECOGNITION
Gerard Peter Cardillo (Ph.D. Thesis) 1967 186 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-6286

In order to classify an input sample to a pattern class in a statistical pattern recognition system, measurements are made on a limited number of features which are used as a basis for classification. For situations in which the cost of taking measurements is large, sequential techniques are employed and two problems arise: 1) How many measurements of a specified sequence are required in order to classify a particular sample? 2) In what order should the features be measured to insure that the expected cost of the classification process is minimized? A general formulation of sequential pattern recognition processes is presented within which a procedure is obtained for the simultaneous optimization of the stopping rule and the stage by stage ordering of features. The optimization procedure is based on backward programming and uses as an index of performance the expected cost of the process, including both the cost of feature measurements and the cost of classification errors. Dissert. Abstr.

N69-15154# Eidgenossische Technische Hochschule, Zurich (Switzerland).
THE GENERATION OF PCM SIGNALS BY THE DIVISION METHOD [DIE ERZEUGUNG VON PCM-SIGNALEN NACH DEM DIVISIONSVERFAHREN]
Emanuel Hafner (Ph.D. Thesis) 1968 129 p refs In GERMAN; ENGLISH summary *Its* Dissertation No. 4086
Avail: CFSTI

The generation of PCM signals by the so-called division method is investigated. After an introduction to this principle, the design of a coder for an experimental 24-channel system is outlined. The properties of the system are discussed. The quantization distortions as well as the maximum permissible variation of the main coder parameters are calculated. This is followed by an investigation of the requirements to be met by the coder circuit with respect to the conversion speed. Experiments with a laboratory system show agreement with the theoretical considerations. An additional digital compression of the PCM signal is proposed and the properties of the improved system are discussed. Author

N69-15155# Industrial Science and Technology Agency, Tokyo (Japan). Electrotechnical Lab.
ALGOL PROGRAMMING
Kiyoshi Sakakibara, Akio Hatano, and Koji Yada Feb. 1968 119 p refs In JAPANESE; ENGLISH summary
(CIRC-185) Avail: CFSTI

This report contains a definitive description of ALGOL, explains its use for different computer processors, and compares the functions of ALGOL 60 and FORTRAN IV. Some shortcomings of ALGOL are discussed. Author

N69-15170 Yale Univ., New Haven, Conn.
INVESTIGATIONS IN SIMULATION AND SIMULATION LANGUAGES
John Joseph Donovan (Ph.D. Thesis) 1967 224 p
Avail: Univ. Microfilms: HC $10.15/Microfilm $3.00 Order No. 68-4852

One view of the process involved in most scientific computer applications is: starting with a problem, set up an abstraction of this problem, and implement this abstraction on a digital computer using a computer language. This dissertation is concerned with the application of this procedure to the digital simulation of complex systems such as a hospital, bank, or factory. Consideration is given to a major problem associated with the syntax of the computer languages used in this procedure, and more generally with the syntax of any computer language. A specification of the syntax of a limited portion of FORTRAN is presented. The restrictions that all statement labels must be different and all reference labels must correspond to statement labels in the same program is defined using this specification. A complete syntactical specification of a computer simulation language, GPSS III, is presented. Results of a digital simulation of the Clinical Chemistry Laboratory of Yale-New Haven Hospital are discussed, along with the method used to obtain these results. Dissert. Abstr.

N69-15330# Royal Aircraft Establishment, Farnborough (England).
THE APPLICATION OF RESIDUE NUMBERS TO COMPUTERS
M. Brandon Feb. 1968 42 p refs
(RAE-TR-68034/UL) Avail: CFSTI

The basic mathematics of residue number computation are described. Algorithms are given for sign determination and magnitude comparison. The application of redundant residue numbers to error detection and correction is discussed, and the lines along which future research may profitably be aimed are indicated. Author

N69-15338# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS IN THE REALIZATION OF AN L-MACHINE
V. I. Kashirov et al 5 Jan. 1968 9 p ref Transl. into ENGLISH from Russian
(AD-678390; FTD-HT-23-1142-67) Avail: CFSTI CSCL 9/2

This work examines the structures of a cell of multidimensional fields of the L-machine, a combination generator and a Gray-code counter of the machines control unit. Author (TAB)

N69-15451# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SPECTRAL DATA HANDLING SYSTEMS
F. P. Brauer and J. E. Schlosser Oct. 1968 26 p refs Presented at Intern. Conf. on Modern Trends in Activation Analysis, Gaithersburg, Md.
(Contract AT(45-1)-1830)
(BNWL-SA-1976-Rev; CONF-681003-7) Avail: CFSTI

Gamma-ray spectrometry is frequently used to identify and estimate radionuclides in neutron activated samples. Spectra observed at different times after neutron exposure are often accumulated on a single sample in order to obtain half-life as well as energy information, and thus estimate both long and short-lived nuclides. The use of multidimensional NaI(Tl) detector configurations or Ge(Li) detectors can result in up to 4000-channel spectra. The quantity and complexity of the data is further increased when the laboratory has a variety of different detector systems and analytical requirements. Electronic data processing techniques can be used to handle the large data volumes associated with modern instrumental activation analysis, and are essential in some multiplex analyzer configurations. Several data processing systems utilizing large digital computing center facilities have been developed by our laboratory for the assembly of spectra files, analysis of the spectra, and storage and retrieval of the analytical results. Author (NSA)

N69-15498*# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
CONVOLUTIONAL CODING TECHNIQUES FOR DATA PROTECTION Progress Report, Aug. 16–Nov. 15, 1968
James L. Massey 5 Dec. 1968 5 p refs
(Grant NGL-15-004-026)
(NASA-CR-99053) Avail: CFSTI CSCL 09B

A new way of viewing the Fano sequential decoding algorithm was developed. The approach was to view the Fano algorithm as a technique for searching an arbitrary value tree. Precise expressions were developed for the number of "forward looks" and "forward moves" made at any node in the value tree, and a precise characterization was obtained for the nature of the final path through the tree found by the algorithm. Research was completed on the task of calculating the probability distribution for the minimum path value along the correct or transmitted path in a value tree resulting from communication over a memoryless symmetric channel such as the additive white Gaussian noise channel. Programming was completed for a sequential decoding facility for a simulated white Gaussian noise channel. The investigation of error propagation in convolutional codes via a stochastic sequential machines approach was also completed. B.P.

N69-15519# Michigan State Univ., East Lansing. Div. of Engineering Research.
STRUCTURE OF EVENTS AND AUTOMATA
B. G. Reynolds 31 Aug. 1968 68 p refs
(Grant AF-AFOSR-1023-67)
(AD-677291; AFOSR-68-2187; ISR-3) Avail: CFSTI CSCL 9/2

The relations between certain structural aspects of automata and their accepted events are investigated. A general repetitive machine is an automaton having a path from every final state to the start state. The general repetitive machines contain as a proper subclass the strongly connected machines. General repetitive events are defined in terms of certain factorization properties of the associated regular expressions, and a one-to-one onto correspondence is shown between general repetitive machines and general repetitive events. Definite and ultimate definite general repetitive machines are investigated, and a number of properties exhibited. All ultimate-definite automata are synchronizable; that is, there is an input sequence which causes the machine to move to a predetermined state regardless of the state of the machine before applying the sequence. Ultimate-definite general repetitive machines are shown to be strongly connected and hence synchronizable to the start state. The structure question is also pursued from the viewpoint of a machines cascade decomposition (Zeigers method). An input to a component machine of a Zeiger cascade either permutes the states or resets to one state. Author (TAB)

N69-15532# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Computer Science.
AN EFFICIENT CONTEXT-FREE PARSING ALGORITHM
Jay Earley (Ph.D. Thesis) Aug. 1968 148 p refs
(Contract F44620-67-C-0058)
(AD-677685) Avail: CFSTI CSCL 9/2

This paper describes a parsing algorithm for context-free grammars, which is of interest because of its efficiency. The algorithm runs in time proportional to n cubed (where n is the length of the input string) on all context-free grammars. It runs in time proportional to n squared on unambiguous grammars, and we actually show that it is n squared on a considerably larger class of grammars than this, but not on all grammars. These two results are not new, but they have been attained previously by two different algorithms, both of which require the grammar to be put into a special form before they are applicable. The algorithm runs in linear time on a class of grammars which includes LR(K) grammars and finite unions of them (and the LR(K) grammars include those of essentially all published algorithms which run in time n), and a large number of other grammars. These time n grammars in a practical sense include almost all unambiguous grammars, many ambiguous ones, and probably all programming language grammars. We present a method for compiling a recognizer from a time n grammar which runs much faster than our original algorithm would have, working directly with the grammar as it is recognized. We show some undecidability results about the class of grammars that are compilable by this method. Author (TAB)

N69-15553 Purdue Univ., Lafayette, Ind.
ANHYSTERETIC MAGNETIZATION AND FLUX REVERSAL IN TAPE CORES, AND AN ANALOG CORE MEMORY
John David Mc Millen (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-8651

The low speed switching mechanism for 50% nickel-iron tape cores is investigated by several experimental procedures. These include finding the high-field response of a core partially switched by a low field, recording the partial hysteresis loop starting from a remanence established by fields of various magnitudes, and switching with low field a core which has been only partially reversed by a high field. Anhysteretic magnetization curves are obtained, and they are related to core geometry. A general summary of switching models for all ranges of switching is presented; from this and the data it is possible to conclude a lower bound on the energy of a 180° domain wall in the tape. An analog memory device is presented and described. This is based upon the concepts of flux reversal presented in this and earlier works. Dissert. Abstr.

N69-15644# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBABILITY CHARACTERISTICS OF RANDOM PROCESSES AND THEIR SIMULATION ON A DIGITAL COMPUTER
L. A. Rastrigin 2 Feb. 1968 10 p refs Transl. into ENGLISH from Avtomat. Vychisl. Tekh. (Riga), no. 13, 1966 p 117–123
(AD-678404; FTD-HT-23-1445-67) Avail: CFSTI CSCL 9/2

One of the methods of generating random processes with an exponential correlation function on a digital computer is analyzed. The peculiarities of the simulation process are investigated, and finite formulas for the parameters of the recurrent dependents are obtained. TAB

N69-15649# University of Southern Calif., Los Angeles. Electronic Sciences Lab.

SOME ASPECTS OF THE NORM REPRESENTATION FOR ARITHMETIC CHECKING AND CORRECTING CODES

C. L. Chiang and I. S. Reed Jun. 1968 121 p refs

(Contract DA-ARO-D-31-124-G929)

(AD-677376; USCEE-276) Avail: CFSTI CSCL 9/4

The properties of the norm representation for integers are extensively investigated. A norm group is defined and the total number of its equivalence classes is found. The number of elements in each equivalence class is computed. The study of the norm representation for integers applies to a development of addition checking and correcting codes. A generalized addition checking and correcting code is proposed, using the concepts of linear spaces. The norm distance between integers is used to define the detecting and correcting capabilities of such codes. Two special cases, the usual AN code and the BN modulo A code, are treated in more detail. The AN code size is found for each value of the constant A. It is shown that the code size of the single error correcting AN code is a monotonically increasing function of A if A is a prime or a power of a prime and 2 or -2 is a primitive root modulo A. Best bounds on the size of AN codes with single error and double error correcting capabilities are found. A BN modulo A code is constructed in such a way that there is no interaction between its information symbol and check symbol. A necessary and sufficient condition for the construction of a single error correcting BN modulo A code is developed. Finally, some new results on optimal single error and multiple error correcting BN modulo A codes are presented. Author (TAB)

N69-15662 Duke Univ., Durham, N. C.

NEW ALGORITHMS FOR THE TRANSIENT ANALYSIS OF NONLINEAR, TIME-VARYING SYSTEMS BY DIGITAL COMPUTER

Peter Edward Jackson (Ph.D. Thesis) 1967 191 p

Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 68-6898

This paper considers several new algorithms for the transient solution of systems which may be linear or nonlinear, time-invariant or time-varying. A notational scheme which combines the best features of the classical transfer function approach and the modern state variable approach is introduced. The effects of the new notation are clearly related to the differences in the schemes, and the advantages of the present technique are pointed out. Among the advantages are an improved treatment of initial conditions over the transfer function approach and a dimensionality of the equations equal to the number of output variables rather than to the total number of state variables as in the state variable approach. The most important decision in the solution procedure is the choice of the step size or sampling interval T. The sampling interval must be short enough that the truncation and propagation errors are kept small, while at the same time, not made so short that computer time is wasted in unnecessary iterations. Dissert. Abstr.

N69-15697*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TIME AND SOURCE ENCODING FOR MULTIPLEXED COMPRESSED SIGNALS

Carlo Joseph Broglio (M.S. Thesis—Md. Univ., College Park) 1969 72 p refs

(NASA-TM-X-61439) Avail: CFSTI CSCL 09B

Sensor data transmitted from a spacecraft to the ground contain much redundancy. Efforts to remove this redundancy, called data compression, tend to be in the form of polynomial predictors in which the data are curve fitted to the longest straight line within a prescribed error tolerance. Once compressed, a major problem in reconstructing the data is that of identifying the time of occurrence of each data point. Five methods are proposed for identifying the time of occurrence of a data point. Two methods are simulated on a CDC 3200 computer and the other three are calculated by using a probability of occurrence table measured by applying zero-order and linear predictors to spacecraft data taken from the Orbiting Geophysical Observatory B satellite. A noise-free environment and a prescribed error tolerance were assumed in the process of obtaining the probability of occurrence table. These proposed methods are analyzed and compared by the use of information theory and the results are presented. Author

N69-15759# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.

CORRECTIONS FOR FREQUENCY DOMAIN TRANSFORMATIONS OF WINFRITH BINARY CROSS CORRELATOR RESPONSES

J. D. Cummins Apr. 1968 13 p refs

(AEEW-R-602) Avail: CFSTI/HMSO: 2s 6d

The corrections for frequency domain transformations of Winfrith binary cross correlator responses are considered: for the finite bandwidth of the equivalent input signal; for the finite time required for the actuator to move between the two positions appropriate to the two levels of the periodic binary chain code input; and for the averaging of experimental determinations of the system frequency response and calculations of the standard deviations of the modulus and phase of the frequency responses determined from the cross correlator responses. Author (NSA)

N69-15857# National Bureau of Standards, Washington, D. C. Inst. for Basic Standards.

ACCESSORY EQUIPMENT AND TELETYPEWRITER MODIFICATIONS FOR REMOTE COMPUTER CONSOLES

Charles H. Popenoe and Robert C. Thompson Feb. 1968 25 p refs

(NBS-TN-419; PB-179432) Avail: CFSTI CSCL 09B

Equipment auxiliary to, and simple modifications of a teletypewriter are described which enable it to be used more efficiently as a remote console of a computer. The descriptions and drawings are sufficiently detailed to enable one to duplicate the modifications or construct the auxiliary equipment with little or no design effort. Among the items treated are: pushbutton work generators, providing automatic typing of often used programming instructions, and option switches for full or half-duplex operation, for inserting the sixth bit for lower case letters, and the eighth bit for parity compatibility. Author (USGRDR)

N69-15967# Illinois Univ., Urbana. Dept. of Computer Science.

COMPUTATIONAL EXPERIENCE IN ALL INTEGER, BINARY VARIABLE, INTEGER PROGRAMMING PROBLEMS USING GOMORY'S ALL-INTEGER ALGORITHM

Charles R. Baugh, Toshihide Ibaraki, and Saburo Muroga 4 Apr. 1968 27 p refs

(Rept-259; PB-179540) Avail: CFSTI CSCL 09B

Computational experience with Gomory's algorithm for the integer linear programming problem of synthesis of optimum networks with NOR gates is presented. The problem is briefly described and accompanied with statistics such as the size and density of the coefficient matrix. Upon successful solution of problems with 90 variables and 240 rows, the effect of constraint orderings and adding additional inequalities was investigated. The difference in convergence of two of Gomory's pivot selection rules is noted. Also the behavior is convergence of feasible versus non-feasible problems is demonstrated. The convergence rate is conjectured to be A. 10 superscript Bn where n is the number of variables of a switching function to be synthesized and A, B are constant coefficients. This rate is compared to an exhaustive method developed by Hellerman to solve the same logical design problem. Author (USGRDR)

N69-15975# Michigan Univ., Ann Arbor.
DESCRIPTION OF A SET-THEORETIC DATA STRUCTURE
David L. Childs Aug. 1968 41 p refs Revised
(Contract DA-49-083-OsA-3050; ARPA Order-716)
(AD-678454; TR-3) Avail: CFSTI CSCL 9/2

This paper is motivated by an assumption that many problems dealing with arbitrarily related data can be expedited on a digital computer by a storage structure which allows rapid execution of operations within and between sets of datum names. Such a structure should allow any set-theoretic operation without restricting the type of sets involved, thus allowing operations on sets of sets of...; sets of ordered pairs, ordered triples, ordered..., sets of variable-length n-tuples, n-tuples of arbitrary sets; etc., with the assurance that these operations will be executed rapidly. The purpose of a Set-Theoretic Data Structure (STDS) is to provide a storage representation for arbitrarily related data allowing quick access, minimal storage, and extreme flexibility. This paper will describe an STDS with the above properties utilizing a general implementation suitable for paging in a mass memory system. Author (TAB)

N69-16061* Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
[INSTRUCTIONAL STRATEGIES FOR OPTIMIZING THE LEARNING PROCESS] Status Report, Jul. 1–Dec. 31, 1968
Richard C. Atkinson 31 Dec. 1968 8 p
(Grant NGR-05-020-244)
(NASA-CR-99052) Avail: CFSTI CSCL 09B

Efforts were centered on the design of a computer-assisted instruction system for teaching programming languages. Objectives are defined as developing a self-contained course in algebraic interpretive dialogue (AID) which is an interactive programming language based on JOSS, and developing an instructional system which will be equally well suited to teaching any interactive programming language, such as BASIC, time-shared FORTRAN, time-shared ALGOL, or APL. The philosophy behind the system design is discussed. As the course will be aimed at relatively mature students, the major part of the system will be designed to allow the student as much control over the sequence of lessons and problems as is feasible. The lesson strand will be essentially linear, based on the assumption that most students will begin with Lesson 1 and continue throughout the sequence. The teaching course will consist of several strands which are logically independent. Three types of strands will be used: lessons, tests, and exercises. It is reported that preliminary specifications were written for analysis procedures, and that a preliminary version of the coding language was developed. M.G.J.

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-15044# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ANALYTICAL COMPUTATION AND MEASUREMENT OF POTENTIAL AND DENSE DISTRIBUTION IN SILICON THREE LAYER DIODES OF LOW AND HIGHEST DENSITY [ANALYTISCHE BERECHNUNG UND MESSUNG DER POTENTIAL- UND DICHTEVERTEILUNG IN SILIZIUM-DREISCHICHTDIODEN VON NIEDEREN BIS ZU HOECHSTEN STROMDICHTEN]
Jean Weiler (Ph.D. Thesis) 1967 105 p refs In GERMAN; ENGLISH summary *Its* Dissertation No. 4021
Avail: CFSTI

An attempt was made to give an analytical solution for the calculation of the static forward characteristic of three layer silicon P+-n-N+ diodes for current densities in the technical range (1 to 10,000 A cm $^{-2}$). These calculations yield the following regions for the static characteristic: *Low currents*: The characteristic of the diode shows a slope whilst the voltage drop in the base region remains constant and the current density is proportional to the excess injected carrier density. *High currents*: The slope of the characteristic changes because of the voltage drop in the base region being a nonlinear function of current density. The current density itself is proportional to the square of the carrier density. *Very high currents*: The characteristic of the diode saturates to a constant voltage drop across the junctions with constant injected carrier densities, whilst the voltage drop across the base region goes proportional to the current density. A diode can be improved by increasing the diffusion length and by reducing the recombination velocity in the highly doped contacts. Author

N69-15125 Pittsburgh Univ., Pa.
ANALYSIS AND DESIGN OF A FILTER EMPLOYING SEQUENTIALLY COMMUTATED MONOLITHIC RC DEVICES
Victor Anthony Richley (Ph.D. Thesis) 1967 175 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-6123

A system which is frequency selective, employs no inductors and is compatible with microelectronic fabrication techniques is presented and analyzed. Essentially, the system sequentially switches monolithic RC thin-film devices to the signal source. An output signal is available only when the switching frequency is the same as or a multiple of the input signal frequency. The frequency response curve thus produced displays the multiple pass band characteristic of a comb filter. A response function is determined as the result of the solution of two transient problems involving the RC thin-film devices and a summation process. Design equations for bandwidth, half-power frequencies, Q and rise time are derived for the filter in both its band-pass and band-stop connections. Dissert. Abstr.

N69-15175 Minnesota Univ., Minneapolis.
NOISE IN MOS FIELD-EFFECT TRANSISTORS
Henry Earnest Halladay (Ph.D. Thesis) 1967 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-7324

The purpose is to present the results of the investigation of the high frequency excess noise in MOS field-effect transistors. The noise characteristics of concern are distinguished from the lower frequency 1/f and g-r noise and have been observed to frequencies on the order of 100 MHz. Two basic types are considered and are distinguished by the current carriers. For the MOS-FETs with electrons as carriers, n-channel units were considered such that experimentally the limiting noise was found to be 4 to 5 times thermal noise. For MOS-FETs with holes as carriers, p-channel devices were investigated where experimentally the limiting noise was found to be 1.5 to 2 times thermal noise. Dissert. Abstr.

N69-15177# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
MICROELECTRONIC ENGINEERING. VOLUME 2: SOME CONSIDERATIONS IN USING MICROELECTRONIC CIRCUITS
William Liben, ed. Dec. 1967 598 p refs
(Contract Now-62-0604-c)
(AD-664481; NAVWEPS-16-1-53-Vol-2) Avail: CFSTI CSCL 9/1

Contents: Models for large signal analysis of junction transistors; Field effect transistors; Preliminaries to circuit design; Digital circuits; Analog circuit design; Special-purpose semiconductor circuits; Reliability considerations; Circuit defects and their detection; Packaging and interconnection; and Damage to microelectronic circuits by nuclear radiation. TAB

N69-15189 Syracuse Univ., N. Y.
DEGRADATION OF GaAs INJECTION DIODES
Stephen Attila Steiner (Ph.D. Thesis) 1967 89 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-5493

The degradation characteristics of GaAs tunnel diodes (T.D.) and light-emitting diodes (L.E.D.) were investigated. The L.E.D.'s were Zn-diffused into n-type substrates. They are grouped into two categories—lightly doped, having a substrate impurity density less than 5×10^{17} cm^{-3}, and heavily doped in the range of $1-5 \times 10^{18}$ cm^{-3}. The degradation rate (properly defined) is proportional to the *injection* current for all devices. We believe that the degradation results from the creation of Frenkel defects by the recombination of *injected* electrons and that all other current components are ineffective. These defects are not moved by the junction field. The results are consistent and predictable for devices in each of the above 3 classes except for those in the lightly doped L.E.D. class where the change in the built-in voltage with aging prevents stress at constant injection current and thus complicates quantitative comparison. Dissert. Abstr.

N69-15199# Industrial Science and Technology Agency, Tokyo (Japan). Electrotechnical Lab.
TRANSIENTS PHENOMENA FOR BRING ABOUT THE POWER SYSTEM FAULTS
Koichiro Terada May 1968 108 p refs In JAPANESE; ENGLISH summary *Its* Res. No. 682
Avail: CFSTI

A digital computer program is presented for analyzing the transient phenomena of faults in electric power systems. Differential equations and the inverse Laplace transformation are used to derive the following types of fault for general power systems: single-line-to-ground, line-to-line, and double-line-to-ground. The equations are obtained by the instantaneous symmetrical component transformation and solved by the positive negative, and zero sequence component quantities. Computations are performed for a simple model system, illustrated by oscillograms and data tables. The computer program, written in FORTRAN IV, is applicable only to radial systems. Also presented are the results of laboratory experiments of Mho relay operations by transient voltages in order to study the effects of coupling capacitor potential devices. K.W.

N69-15211# Princeton Univ., N. J. Dept. of Electrical Engineering.
ROUND-OFF ERROR OF FLOATING-POINT DIGITAL FILTERS
T. Kaneko and B. Liu [1968] 10 p refs Presented at the 6th Ann. Allerton Conf. on Circuit and System Theory, 2-4 Oct. 1968 Submitted for publication
(Grants AF AFOSR-1333-67; NSF GK-1439)
(AD-677323; AFOSR-68-2113) Avail: CFSTI CSCL 9/5

This paper is concerned with the accuracy problem of digital filters. When a computer using fixed-point arithmetic is used for the realization of the filter, the problem has been studied extensively. The only result available for floating-point arithmetic realization of digital filters is an absolute upper bound on the accumulation of the round-off error using a deterministic approach. The bound is over pessimistic as to be expected. In this paper, a statistic approach is adopted to treat the round-off error problem for floating-point computer realization of filters. Author (TAB)

N69-15303 Wisconsin Univ., Madison.
INVESTIGATION OF BEAM WAVEGUIDE RESONATORS AT MILLIMETER WAVELENGTHS
Arthur William Murphy (Ph.D. Thesis) 1968 205 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-5338

During experimental efforts to utilize the beam waveguide resonator as a filter element at millimeter wavelength frequencies, it was found that the measured resonator Q did not conform to theory. A resonator was used which should have had an unloaded Q of 600,000 based on the loss mechanisms of mirror edge diffraction and resistive absorption. The measured unloaded resonator Q was 23,000. No other energy loss mechanisms were known to exist in the resonator which could cause a reduction in Q of this magnitude. Dissert. Abstr.

N69-15313*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
ANALYTICAL STUDY AND EXPERIMENTAL INVESTIGATION OF TECHNIQUES FOR IMPROVING ELECTRON TUBES FOR SPACE APPLICATION Final Report
E. C. Conway and M. J. Kelley Dec. 1968 229 p refs
(Contract NAS12-565)
(NASA-CR-86118) Avail: CFSTI CSCL 09A

A triode was designed and constructed with a heat pipe integrated into its cathode structure to allow the use of an external heater. A promethium-147 isotope heat source was used to heat the cathode. It was found that a higher power density source, such as curium-244, is much better suited to cathode heating. Using curium-244, the isotope is small enough to be inserted into the cathode support, thus eliminating the need for a heat pipe. An investigation of high power tubes indicated that most existing tubes are not suited to heat pipe cooling, since passages designed for liquid cooling are inadequate for use as evaporators. Integration of heat pipe evaporators into these tubes can be accomplished, however, with either modifications in existing designs or a completely integrated approach to the overall tube design. To demonstrate heat pipe cooling, a travelling wave tube was operated using heat pipe cooling. With 930 watts dissipated at the collector, the operating temperature of 200°C was not exceeded. Author

N69-15407# California Univ., Berkeley. Lawrence Radiation Lab.
SYSTEM OF FAST INTEGRATED CIRCUIT LOGIC FOR PHYSICS INSTRUMENTATION
Frederick A. Kirsten and Dick A. Mack 29 Jul. 1968 11 p Presented at Intern. Symp. on Nuclear Electron., Versailles, France, 10-13 Sep. 1968
(Contract W-7405-eng-48)
(UCRL-18166; CONF-680906-6) Avail: CFSTI

A particularly important problem is to design a system of hardware for integrated circuits that not only preserves their speed characteristics and provides flexibility of interconnections where necessary, but also preserves their great cost advantage when used to construct large systems of logic. Groups of integrated circuits are assembled onto logic cards to form the logic modules most useful for physics instrumentation. Fast input and output connections are made by means of an inexpensive transmission-line connector used in conjunction with a commercially available card-edge connector. Power supply voltages are chosen to make all logic levels NIM compatible. A particular example of a medium-scale logic array—a 36 channel hodoscope register—is given. Author (NSA)

N69-15441# Michigan Univ., Ann Arbor. Electron Physics Lab.
E-TYPE PHOTODEMODULATORS FOR COHERENT LIGHT SIGNALS Final Technical Report
John L. Mason Aug. 1968 47 p refs
(Contract DA-ARO-D-31-124-G634)
(AD-677374; REPT-07094-1-F) Avail: CFSTI CSCL 9/1

The theoretical studies are summarized and an experimental investigation is reported for an E-type traveling-wave phototube. The principal feature of such a device is the centrifugal electrostatic focusing of the electron beam. The theoretical study yields a small-signal power theorem, the types of waves propagating along

a thin E-type beam, and a small-signal analysis of the traveling-wave phototube. An expression for the equivalent resistance of the device is derived, with numerical results given for the case of zero circuit loss, zero space charge, and synchronous beam velocity. For comparison, equivalent resistance values are given for O-type phototubes. The experimental investigation involved a phototube designed to operate at S-band. Design considerations and measurement techniques are discussed. Experimental curves for the equivalent resistance are presented and compared with the theoretical results. Author (TAB)

N69-15560# Academy of Sciences (USSR), Moscow. Institut Atomnoi Energii.
NUVISTOR PREAMPLIFIER FOR WORK WITH SEMICONDUCTOR DETECTORS
Yu. F. Rodionov and F. S. Shiryaev 1967 8 p refs In RUSSIAN
(IAE-1453) Avail: Issuing Activity

A low noise charge preamplifier based on metalloceramic nuvistor tubes has been developed for work with semiconductor radiation detectors. Electrical and wiring diagrams are presented, and operating characteristics are given. The noise level of the amplifier is $\cong 2.1 \pm 0.4$ C (input/output). Author (NSA)

N69-15566 Wisconsin Univ., Madison.
COMPUTER ORIENTED ALGORITHMS FOR SYNTHESIZING MULTIPLE OUTPUT COMBINATIONAL AND FINITE MEMORY SEQUENTIAL CIRCUITS
Yueh-Haung Su (Ph.D. Thesis) 1967 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-1106

Two techniques for synthesizing finite memory asynchronous sequential circuits are presented. It is shown that we can either construct the Huffman flow table first, then transform the flow table to a function array; or construct the function array directly from the work statement of a sequential problem. The various steps, such as merging the flow table, making the secondary assignments and constructing the Y and Z matrices, which are required by Huffman's method are avoided and hence the amount of labor required to solve a sequential problem is reduced. Once the function array is constructed, the rest of the sequential circuit problem becomes a combinational circuit problem. Therefore, a computer algorithm for synthesizing combinational circuits can be used as part of the algorithm for synthesizing sequential circuits; hence larger size sequential problems can be solved. Dissert. Abstr.

N69-15735*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
APPLICATION OF ELECTRON AND LASER BEAMS TO SPACECRAFT ELECTRONIC JOINING
V. F. Lardenoit 15 Sep. 1968 30 p refs
(Contract NAS7-100)
(NASA-CR-99138; JPL-TM-33-396) Avail: CFSTI CSCL 09A

A survey was made of electron beam and laser techniques as applicable to spacecraft electronic joining. A brief description is presented, of conventional and advanced joining techniques requiring contact between the parts to be joined and the joining equipment, for comparison to focused energy devices which do not require contact. Advantages and disadvantages of the laser and electron-beam devices are discussed, as is device operation. Results of evaluation tests as well as typical applications for both laser and electron beam welders are presented. Certain data and applications were not available due to their proprietary nature. The information was obtained through literature reviews and discussions with manufacturers and users of these devices. New developments and required improvements are also briefly discussed. Author

N69-15802*# University Coll. of North Wales, Bangor. School of Engineering Science.
THE APPLICATION OF CHANNEL ELECTRON MULTIPLIERS TO SCANNING ELECTRON MICROSCOPY Progress Report
D. A. Shaw Nov. 1968 8 p refs
(Grant NGR-52-117-001)
(NASA-CR-99164) Avail: CFSTI CSCL 20F

This note describes how high resolution, low noise micrographs can be obtained by using low beam current and shows also that the bandwidth of the system is severely limited. Line speeds of the order of .2 sec have to be employed. Two multipliers are incorporated in the cathodoluminescent collection system, using channel electron multipliers, to provide compositional information for topographic information. Author

N69-15878 IIT Research Inst., Chicago, Ill.
SYNTHESIS OF SYMMETRICAL TEM-MODE COUPLED TRANSMISSION LINE DIRECTIONAL COUPLERS
Peter Pantelis Toulios (Ph.D. Thesis) 1968 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-6882

The purpose of this study is to establish quantitative design criteria for symmetrical TEM-mode coupled transmission-line directional couplers of three and five sections utilizing exact synthesis procedures. Such synthesis procedures and design criteria are given for various coupler designs. These synthesis procedures are based on the analytical equivalence of directional couplers to stepped-impedance filters, which are synthesized on an insertion-loss basis. The stepped-impedance filters can be treated using Richards' theorem for the synthesis of transmission-line distributed networks, as described previously by Riblet. New equal-ripple odd polynomials of third and fifth order are determined and used to express the required insertion-loss function. In general, these polynomials cannot be expressed in terms of known Chebyshev polynomials. However, it is shown that a third-order Chebyshev polnomial of the first kind, with a properly constrained argument, can be used to obtain a realizable insertion-loss function for three-section symmetrical couplers. Explicit formulas for the parameters of three-section symmetrical couplers are given. Dissert. Abstr.

N69-16055# Communication Satellite Corp., Washington, D. C.
FILTER DESIGN FOR MULTIPLE TRANSPONDERS
B. Blachier 14 Jun. 1968 38 p
(PB-179455; CL-10-68) Avail: CFSTI CSCL 09E

The feasibility of the RF Intelsat IV input and output filters are discussed within the frame work of the following questions: How closely can we meet the desired transmission specifications; How far can we go in reducing size and weight; Two kinds of filters are considered: Tchebycheff, Elliptic (or cauer). Both are minimum phase circuits and give, from our point of view, the best amplitude response in the passband for COMSAT applications. Unfortunately, since the amplitude and phase response are the Hilbert transform of each other in a minimum phase circuit, the response of these filters cannot meet the required out of band rejection and band edge time delay requirements. We have to add equalizers to cancel or reduce the time delay variation. No other way is possible with a minimum phase circuit. Nonminimum phase circuits are not discussed here. Author (USGRDR)

N69-16056# Rensselaer Polytechnic Inst., Troy, N. Y. Div. of Electrophysics.
HIGH FREQUENCY SOLID-STATE POWER RECTIFICATION
K. E. Mortenson, P. E. Bakeman, Jr., and W. C. Taft Dec. 1967 42 p refs
(Contract C-117-66)
(PB-179465; TR-EP-6803) Avail: CFSTI CSCL 09A

This report covers the progress made on high frequency power rectification from September 1966 to September 1967. The requirements for a high frequency rectifying diode are reviewed. The germanium-gallium arsenide p-n heterojunction diode is presented and its material requirements, fabrication technology, and packaging are discussed. The circuit requirements for high frequency rectification are considered, and a new lumped circuit test jig was designed and built. The development of a 220 MHz one kilowatt rectification test facility is reported. Finally, a continuous rectified DC output power of 28 watts was obtained from a 220 MHz source using a single germanium-gallium arsenide heterojunction diode. The overall recification efficiency of a similar heterojunction diode including circuit losses was 72%. Author (USGRDR)

N69-16096# Army Electronics Command, Fort Monmouth, N. J. Electronic Components Lab.
ONE-MEGAWATT AVERAGE-POWER MODULATOR
Anthony J. Buffa and Frederick A. Vorwerk Oct. 1968 17 p refs
(AD-678456; ECOM-3036; OSD-1366) Avail: CFSTI CSCL 9/5

A one-megawatt average-power thyratron is being constructed and the facility for testing such a tube has been built. The dc power supply is designed to deliver 30 amperes at 40 kilovolts. Some flexibility in selecting operating parameters for the tube has been incorporated in the equipment. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-15026# Technische Hochschule Munchen (West Germany).
CONTRIBUTION TO THE THEORY OF A CATEGORIZER NETWORK FOR BINARY 1-OUT-OF-M CODES [BEITRAG ZUR THEORIE EINER ZUORDNERSTRUKTUR FUER BINAERE 1-AUS-M-CODES]
Victor Sandoval (Ph.D. Thesis) 1968 17 p refs In GERMAN, ENGLISH summary
Avail: CFSTI

The characteristics of a categorizer network are investigated which classifies each of a given set of n-component input vectors into one of m allowable classes. This network has been labeled "1m-categorizer", "1m" being an abbreviation for 1-out-of-m codes. Categorization is effected by a structure consisting of n inputs and m outputs, whereby each input is connected to each output through linear weights. An n-component input vector is considered to belong to class q if the q^{th} output is larger than any of the other outputs. It is shown that the 1m-categorizer generates separating hyperplanes which partition the n-dimensional input signal space into m sections. Each of these sections is then assigned a category, so that all input vectors in a given section are said to belong to the category assigned this particular section. Author

N69-15055 Oklahoma State Univ., Stillwater.
A STUDY OF THE APPLICABILITY AND SYNTHESIS OF REDUNDANT, THRESHOLD LOGIC DECISION-MAKERS
John L. Youngblood (Ph.D. Thesis) 1967 194 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 68-8529

A distinction is made between the areas of applicability of binary decision makers which possess distributed redundancy characteristics and those of conventional binary redundant decision makers. A mathematical technique for introducing redundancy into threshold logic decision makers is then investigated, based on systems of linear inequalities which characterize threshold logic units. It is found that decision makers which possess the characteristics attributed to distributed redundancy are most applicable to decision problems in which all combinations of binary inputs are likely to occur. If threshold logic decision-makers are used in the role of decision-makers with distributed redundancy, the type of problem to which they are applicable requires the use of networks of threshold logic units rather than single threshold logic units. A redundancy synthesis algorithm demonstrates the possibility of iteratively selecting redundant threshold logic units. Using the algorithm, a potentially useful characteristic of redundant threshold logic networks is revealed. Dissert. Abstr.

N69-15142 Wisconsin Univ., Madison.
ANALYSIS OF NONLINEAR FEEDBACK CONTROL SYSTEMS USING METHODS STEMMING FROM THE CALCULUS OF VARIATIONS
Richard Sebastian Marleau (Ph.D. Thesis) 1968 269 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.50 Order No. 68-5334

A detailed account of the describing-function method is given, with emphasis on the motivation for defining the various describing-functions detailed in the literature. Next, some of the basic aspects of the calculus of variations as pertinent to this thesis research are detailed. Then using techniques arising therefrom (first, one-harmonic approximation; second, multi-termed approximation; and, third, various forms of nonharmonic approximation) determination of the ultimate-state periodic response of nonlinear control systems is effected and the results so obtained compared with those arising through use of presently available techniques. It is to be seen that application of the variational methods yield results not only at least as good as those afforded by describing-function analysis, but in general afford more accurate results. Dissert. Abstr.

N69-15195 Pennsylvania Univ., Philadelphia.
OPTIMIZATION OF NONLINEAR SYSTEM RESPONSE USING THE LIAPUNOV FUNCTION
Ashok Harishchandra Pradhan (Ph.D. Thesis) 1967 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-4605

An effective and useful method has been found for enabling the control system designer to compute analytically the optimum values of the adjustable parameters of any given asymptotically stable nonlinear system such that the response of this system to specified deterministic inputs will approach the specified model response as closely as is possible with the allowed freedom in design. A new performance index has been employed for the above optimization on nonlinear system response. Use of the Liapunov function is made for evaluating this performance index for the given nonlinear system. In addition to the usually used search for an optimum with respect to the adjustable parameters of the system, a new concept of optimization is introduced. This concept consists in seeking the optimum of the objective function with respect to the time-constants of the chosen class of model responses and forcing this optimum to occur at the values of the time-constants of the specified model response. Dissert. Abstr.

N69-15412*# Arizona Univ., Tucson. Engineering Experiment Station.
TOPICS CONCERNING STATE VARIABLE FEEDBACK IN AUTOMATIC CONTROL SYSTEMS. PART 1: SPECIFICATION. PART 2: SENSITIVITY. PART 3: INTENTIONAL NONLINEARITIES. PART 4: UNAVAILABLE STATES
Donald G. Schultz, Robert C. White, Joseph H. Dial, Hasmukhrai B. Parekh, and Milo E. Muterspaugh 1968 349 p refs
(Grant NGR-03-002-115)
(NASA-CR-99038) Avail: CFSTI CSCL 09E

Four separate reports relating to state variable feedback methods in automatic control systems are summarized. General rules are given for the selection of the performance measures of synthesizing linear control systems. Design charts are presented so that a low order model can be constructed from the design specifications. Two new time domain sensitivity measures, integral and peak sensitivity, are defined in terms of the sensitivity function. A relation between integral and classical frequency domain sensitivities is established and the generation of classical sensitivities, sensitivity function, peak sensitivity, and integral sensitivity is discussed. A modification of state variable feedback, the H-equivalent system, is considered in a further attempt to reduce sensitivity to parameter changes. A particular type of nonlinear state variable feedback system is discussed. The system contains a single nonlinearity, and it is shown by describing function techniques and examples that the optimum location of the nonlinear element for maximum control is at the left end. A method for designing gain insensitive systems is presented. Three techniques are presented for generating unavailable states to realize a desired closed-loop response; they are compared on the basis of peak and integral sensitivity. B.P.

N69-15499# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SIGNALING AND PREDICTION OF FAILURES IN DISCRETE CONTROL DEVICES WITH STRUCTURAL REDUNDANCE

M. A. Gavrilov 7 Dec. 1967 17 p refs Transl. into ENGLISH from Russian

(AD-678343; FTD-HT-23-1454-67) Avail: CFSTI CSCL 14/4

Methods involving structural redundancy are of great importance in solving the problem of reliable operation of automatic control devices. This article examines certain fundamental possibilities of signaling or predicting breakdowns in automatic control devices. One principle previously described by the author which governs these possibilities is that determination of the minimum number of extra internal elements necessary to provide requisite reliability completely coincides with the problem of determining the minimum number of supplementary symbols needed to construct correction codes for the corresponding number of mistakes. This method involves construction of tables of states and relates to the case where failure probability is the same for all internal elements, element failures are symmetrical, and individual failures are independent. Other conditions demand a different approach. The discussion expands the application of this method. TAB

N69-15622 Purdue Univ., Lafayette, Ind.

OPTIMAL FEEDBACK CONTROL OF TUBULAR PROCESSES

Yen-Ping Shih (Ph.D. Thesis) 1967 139 p

Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-8359

Necessary conditions are given for a local extremum of an integral performance criterion, for control of a class of partial differential equations, with the control variable a function of time only. A weakly sufficient condition is also derived for a local minimum. For the linear hyperbolic system with a quadratic performance criterion and no boundary forcing, a linear feedback control law is derived. The linear feedback control law indicates that the state variable must be measured at every position. In general, the optimal gain is a function of spatial coordinate and time and can be obtained by solving a linear implicit partial differential equation. For the special case that the system is completely controllable and the final time approaches infinity, the optimal gain is a function of spatial coordinate only. The theory is then applied to the optimal control of heat exchangers. Dissert. Abstr.

N69-15652# RAND Corp., Santa Monica, Calif.

SOVIET CYBERNETICS: RECENT NEWS ITEMS, NUMBER 22

Dorothy McDonald, ed. Oct. 1968 85 p refs

(AD-677362; P-3600/22) Avail: CFSTI CSCL 9/2

Contents: Automated control of the instrument-building industry; Network diagrams in the control of research organizations; Trends in mathematical psychology; Inefficient utilization of computers; Higher schools - information center; Higher schools - Automated data system; Computer production in Poland; Tactical exercises and mathematics; Analysis of daily activity of scientists; Automated control system for the state standards inspectorate; A 1000 GEV cybernetic accelerator; and Avtodispetcher system of industrial control. TAB

N69-15661 Illinois Univ., Urbana.

MINIMAX CONTROLLER DESIGN

David Matthew Salmon (Ph.D. Thesis) 1967 108 p

Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-8211

The concept of performance-sensitivity is introduced to meet the usual criticism of minimax or "worst-case" design, that it is too pessimistic in concentrating all attention on the worst parameters. Properties of minimax control with a performance-sensitivity as the index are developed. It is shown that the usually desired range of system properties can be achieved by minimaximizing either the system performance index or a performance-sensitivity. A new algorithm for solving algebraic minimax problems, regardless of the presence of a saddle point, is presented and proved to converge. A method of obtaining multi-point optimality with time-varying controllers is presented. A general approach to the design of controllers for uncertain systems is presented. Several examples illustrate the utility and practicality of the methods developed. Dissert. Abstr.

N69-15790# Joint Publications Research Service, Washington, D. C.

ADJUSTMENT OF ADAPTIVE SYSTEMS INVESTIGATED

23 Dec. 1968 38 p refs Transl. into ENGLISH Avtoma i Telemekhan. (Moscow), no. 9, 1968 p 98-122

(JPRS-47128) Avail: CFSTI

CONTENTS:

1. AN ADAPTIVE SYSTEM WITH RANDOM SEARCH FOR THE EXTREMUM V. V. Taran p 1-16 refs (See N69-15791 05-10)

2. CONTROL PROCESSES IN THE RESPIRATORY SYSTEM N. V. Zavalishen et al p 17-37 refs (See N69-15792 05-04)

N69-15791# Joint Publications Research Service, Washington, D. C.

AN ADAPTIVE SYSTEM WITH RANDOM SEARCH FOR THE EXTREMUM

V. V. Taran *In its* Adjustment of Adaptive Systems Invest. 23 Dec. 1968 p 1-16 refs (See N69-15790 05-10)

Avail: CFSTI

This article contains an investigation of a method of constructing adaptive systems made of single-type and independently adapting circuits. The mechanism of centralized control of the adjustable parameters is missing in this method, and the signal of a change in control process quality is sent to all the adjustable circuits simultaneously. The adjustment is made by the random search method. The dynamics of the system are investigated for a single-extremal quality function. The structural diagram of execution of the adjustment algorithm is presented. Author

N69-15804# Joint Publications Research Service, Washington, D. C.
DEVELOPMENTS IN AUTOMATIC CONTROL AND NEURON SENSITIVITY
13 Jan. 1969 35 p refs Transl. into ENGLISH from Avtoma i Telemekhan. (Moscow), no. 10, 1968 p 97–108, and 119–127
(JPRS-47238) Avail: CFSTI

CONTENTS:
1. DEVELOPMENT OF AUTOMATIC CONTROL SYSTEMS O. I. Aven p 1–19 (See N69-15805 05-10)
2. NEURON SENSITIVITY M. L. Bykhovskiy et al p 20–32 refs (See N69-15806 05-04)

N69-15805# Joint Publications Research Service, Washington, D. C.
DEVELOPMENT OF AUTOMATIC CONTROL SYSTEMS
O. I. Aven *In its* Develop. in Autom. Control and Neuron Sensitivity 13 Jan. 1969 p 1–19 (See N69-15804 05-10)
Avail: CFSTI

This article contains a study of some problems in the development of computerized automatic planning and control systems. The problems which must be solved when developing such systems are listed. Procedures which will give the best results are recommended. Author

N69-15836# Joint Publications Research Service, Washington, D. C.
FOURTH ALL-UNION CONFERENCE ON AUTOMATIC CONTROL
Ya. Golovanov 31 Dec. 1968 7 p refs Transl. into ENGLISH from Pravda (Moscow), 28 Nov. 1968 p 2
(JPRS-47161) Avail: CFSTI

A report on the cybernetics conference held at Tbilisi, U.S.S.R. is presented. Topics included the spheres of economics and outer space, control of automatic machines and problems of automatic machine junctions, and new elements in technical cybernetics and thinking robots in motor vehicles. A.C.R.

N69-15879 Syracuse Univ., N. Y.
A STABILITY THEORY FOR NONLINEAR DISTRIBUTED NETWORKS
Alan Neil Willson, Jr. (Ph. D. Thesis) 1967 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-5498

Electrical networks consisting of lumped linear and memoryless nonlinear elements and an arbitrary number of lossless transmission lines are considered. It is shown that a large class of such networks may be described by a system of functional-differential equations. A Lyapunov functional is presented and used to obtain several theorems concerning the stability and instability of the equilibrium solution, $\bar{x} = \bar{0}$, of the network. Several examples of the theory are presented. Dissert. Abstr.

N69-15890*# Scripta Technica, Inc., Washington, D. C.
AN AUTOMATIC CONTROL SYSTEM OF PHOTOMULTIPLIER GAIN AND OF RELATIVE LINEAR ELECTRONIC COUPLING [UN SISTEMA DI REGOLAZIONE AUTOMATICA DEL GUADAGNO DI UN FOTOMOLTIPLICATORE E DELLA RELATIVA CATENA ELETTRONICA LINEARE]
C. Bacci, R. Baldini-Celio, and V. Bidoli Washington NASA Oct. 1968 12 p refs Transl. into ENGLISH from Comit. Nazl. Energia Nucl. (Frascati), Rept. LNF-67/11, 1967 p 11
(Contract NASw-1694)
(NASA-TT-F-11792; LNE-67/11) Avail: CFSTI CSCL 09E

In order to analyze the pulse heights originating from various integral Pb Cerenkov window counters, an automatic gain control (AGC) system was designed to ensure the time stability of the gain of a photomultiplier (PM) and of the linear electronic channel which transmits the pulses to be analyzed. The light source consists of a plastic scintillator with Po^{210} deposited on it. The light produced in the scintillator by the α rays emitted by the Po is transmitted either to the PM to be controlled, or to a small auxiliary PM which is used in coincidence with the PM so as to separate the pulses produced by the α rays of the Po from the background radiation. The pulses pass through the linear electronic channel and are then sent to the AGC system. A block diagram and circuit schematics are included. Advantages of the system are cited as the capability to operate in the presence of a strong background radiation. M.G.J.

N69-15945# Bureau of Reclamation, Denver, Colo. Electric Power Branch.
EXCITATION SUPPLEMENTARY CONTROL BY A MULTILOOP SYSTEM FOR CONFINEMENT OF PARAMETER VARIATIONS
F. R. Schleif and W. B. Gish Apr. 1968 33 p refs
(EP-25; PB-179587) Avail: CFSTI CSCL 10B

Development of stabilizing effort from rotating exciter systems by means of supplementary control from speed or frequency has been indicated by analog studies, but field tests disclosed variation between performance of field apparatus and computer model. By development of a model to represent characteristics of working excitation systems, frequency response curves of the systems and their generators were matched. The model was studied for a possible combination of adjustments to reduce phase lags of the exciter system. This effort supported conclusions that of the limited adjustments available only slight improvement would be possible, the principal limitation resulting from the time constants of the apparatus, especially the amplidyne. USGRDR

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-15383# Brookhaven National Lab., Upton, N. Y.
THE SUPERCONDUCTING MAGNET FOR THE BROOKHAVEN NATIONAL LABORATORY 7-FOOT BUBBLE CHAMBER
D. P. Brown, R. W. Burgess, and G. T. Mulholland Jul. 1968 36 p refs Submitted for publication Supported in part by AEC
(BNL-12897; A-201) Avail: CFSTI

An air core, fully stabilized superconducting magnet which has been constructed for the Brookhaven National Laboratory 7-foot bubble chamber is described. The magnet incorporates conductor face cooling and stainless steel reinforcement in an effort to maximize the performance-cost ratio. The design approach is integral with that of the bubble chamber. The conductor selection, the magnet design, construction considerations, cryogenic support facilities, and preliminary test results are described. Author (NSA)

N69-15511*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
APOLLO/SATURN 5 COMPLEX 39, LAUNCH AREA B OPERATIONS: RP-1 FUEL SYSTEM

7 May 1968 130 p refs supersedes TM-452, 1 Jan. 1968
(NASA-TM-X-61429; TM-452; Rept-75M14887) Avail: CFSTI CSCL 22D

A description is presented on the capabilities and functions of the RP-1 fuel systems, which is a permanent ground based installation for prolonged storage of fuel and provides high volume remotely controlled fuel transfer to the launch vehicle. Detailed operating check lists for (1) systems control, (2) systems preparation, (3) automatic sequences, and (4) systems shut down are included. Malfunction procedures and probable causes are given. F.O.S.

N69-15529# Joint Publications Research Service, Washington, D. C.
WORLDWIDE COSMODROMES, SPACE LAUNCHES DISCUSSED
2 Jan. 1969 11 p refs Transl. into ENGLISH from Mosk. Komsomolets, no. 32, 3 Oct. 1968 p 4
(JPRS-47168) Avail: CFSTI

Spacecraft launching bases, or cosmodromes, are reviewed. Baykonur, Cape Kennedy, U.S. Western Missile and Space Range, Hammagir, Woomera, Tehumbe, and Kascsima bases are discussed. B.P.

N69-15567# National Aerospace Lab., Amsterdam (Netherlands).
[NATIONAL AEROSPACE LABORATORY] Annual Report, 1967
1967 89 p refs In DUTCH; ENGLISH summary
Avail: CFSTI

Summaries of selected projects in applied aeronautical research are presented dealing with static and fatigue tests of the F-28 transport aircraft, theoretical studies of transonic flow, and wind tunnel experiments in stationary and unstationary aerodynamics of wings and control surfaces. Combustion and propulsion studies are briefly described, and an outline is given of structural and material studies to determine loads, strength, stiffness, fatigue and crack propagation, and flutter for the F-28 aircraft. Progress of work in aircraft flight mechanics and operations is reviewed. Work performed in space research and technology included control and reliability studies of a sounding rocket, aerodynamic design of the ELDO launch vehicle, and testing of an attitude reference and program unit. The activities of the laboratory's scientific and technical committees are mentioned, and a report on personnel and administrative matters is included. K.W.

N69-15568# Brookhaven National Lab., Upton, N. Y.
Q MEASUREMENTS ON SUPERCONDUCTING CAVITIES AT S-BAND
H. Hahn, H. J. Halama, and E. H. Foster [1968] 5 p refs Presented at Summer Study on Superconducting Devices and Accelerators, Upton, N. Y., 10 Jun.–19 Jul. 1968 Supported by AEC
(BNL-12828; CONF-680621-7) Avail: CFSTI

Q measurements were made on a TE_{011} microwave cavity resonant at 2.87 GHz and constructed of superconducting deflectors made of lead electroplated on OFHC copper. Experimental results for the temperature dependence of the surface impedance of superconducting lead at constant frequency and low power levels are presented. NSA

N69-15581# Brookhaven National Lab., Upton, N. Y.
DESIGN PROBLEMS IN SUPERCONDUCTING RF BEAM SEPARATORS
H. J. Halama [1968] 17 p refs Presented at Summer Study on Superconducting Devices and Accelerators, Upton, N. Y., 10 Jun.–19 Jul. 1968 Supported by AEC
(BNL-12848; CONF-680621-13) Avail: CFSTI

Problems in the design of an rf beam separator which employs two superconducting cavities are discussed. The effects of operating frequency, improvement factor, and peak field on the design of a separator are considered. Optimization of the deflector including structure and stability considerations is described. A block diagram of the microwave system is included. NSA

N69-15633*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF NONEQUILIBRIUM AIR STREAMS IN THE AMES 1-FOOT SHOCK TUNNEL
Robert S. Hiers, Jr. and John O. Reller, Jr. Washington Jan. 1969 27 p refs
(NASA-TN-D-4985) Avail: CFSTI CSCL 14B

An analysis and the results of a preliminary calibration of nonequilibrium test streams in the Ames 1-foot shock tunnel are presented. The facility is combustion driven and is normally operated in the tailored-interface mode to provide a nominal reservoir enthalpy of 9,100 J/gm and pressure of 275 atm. In addition, the shock tunnel is operated in the equilibrium-interface mode to provide enthalpies between 6,000 J/gm and 15,000 J/gm at a nominal reservoir pressure of 275 atm. Results are presented for three typical operating conditions. Static pressure, pitot pressure, velocity, mass flow, and stagnation point heat transfer were measured in the test stream. These data are compared with numerically integrated and sudden-freeze models for air undergoing both chemical and vibrational relaxation. It is shown that the sudden-freeze model is satisfactory for calibrating the test stream if certian frozen-flow parameters are determined using experimental data. An added advantage of this approach is that flow properties in the test stream may be obtained without specifying the relaxation rates. Author

N69-15696*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
COMPOSITE MECHANICAL SIMULATION
H. T. Blaise 1 Dec. 1968 129 p
(NASA-TM-X-53753) Avail: CFSTI CSCL 14B

This report contains an account of work accomplished in the development and testing of the Lunar Gravity and Earth Orbital Simulator, or Parallogram. The parallelogram approach was chosen over other alternates on the basis of easy adjustment and proven low friction capability of ball bearings under proper lubrication and loading conditions. The inherent drag hysteresis of cables and negator springs or other spring type devices plus their lack of adjustability and the linearity and the relative expense of servo-controlled devices were all considered in the choice of the parallelogram. A parallelogram was developed to mate with the five-degree-of-freedom simulator and to provide additional flexibility of use through a demountable floor and an air bearing system to enable more sophisticated zero g testing. Author

N69-15721# Federal Aviation Administration, Washington, D. C. Systems Research and Development Service.
SEALANTS FOR SAW KERFS IN FLEXIBLE PAVEMENTS
John P. Cook and Chris Seibel, Jr. Dec. 1968 18 p refs
(SRDS-RD-68-33) Avail: Issuing Activity

Investigations were made of saw kerf installations for in-runway lighting systems in various parts of the country. Personal inspections and/or review of reports were made of nine installations. Mail or phone contact was established to determine a condition report for several others. Forty-four different materials were checked and considered for use in saw kerf sealing. A recommended specification for a flexible sealing compound, coal tar binder epoxy resin base is given. Author

N69-15829# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
A SIMULATED STAR REFERENCE SYSTEM FOR THE SINGLE AXIS SIMULATOR
C. B. Connor Paris ESRO Nov. 1966 27 p
(ESRO-TM-P-75(ESTEC)) Avail: CFSTI

Details of four parts of the control system for the Single Axis Simulator are given. The parts discussed are the star source, the star sensor, the system for introducing random noise and steady offsets and the star sensor controller. A group of three star sources and corresponding star sensors provide position sensing in one axis. The system for introducing random noise and steady offsets provides three independent outputs, one for each sensor channel. The star sensor controller provides system logic and driving circuits which enable any combination of star sensors to be used under the most favorable conditions considering star presence, occultation by earth or satellite and large or small error signals. Author (ESRO)

N69-15845# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
PROPOSED SINGLE AXIS DYNAMIC SIMULATOR
A. Robinson and B. Sunesson Paris ESRO Oct. 1965 35 p
(ESRO-TM-P-73(ESTEC)) Avail: CFSTI

A single axis dynamic simulator project is examined from every aspect to demonstrate its preliminary value in the development program of the Large Astronomical Satellite. Author (ESRO)

N69-15860# Joint Publications Research Service, Washington, D. C.
HISTORY OF "CHERNOMOR" UNDERWATER LABORATORY
A. Podrazhanskiy et al 12 Dec. 1968 10 p Transl. into ENGLISH from Tekhn. Molodezhi (Moscow), Nov. 1968 p 5-6
(JPRS-47071) Avail: CFSTI

A brief account of Soviet underwater laboratories is presented. The history of construction of these underwater houses, since 1966, is discussed. The main diagrams of the life support systems of one such laboratory, the Chernomor, are depicted. B.P.

N69-15904# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
MECHANICAL DESIGN OF THE SINGLE AXIS SIMULATOR
D. C. Clayton Paris ESRO Dec. 1966 34 p
(ESRO-TM-P-80(ESTEC)) Avail: CFSTI

This note describes the basic concept of the structure and mechanical systems required to satisfy the fundamental requirements and design philosophy of the Simulator. This philosophy is discussed in detail in ESRO TM(P)-73 but in general the simulator structure is designed to match as far as possible the characteristics of the Large Astronomical Satellite as it was envisaged in the Autumn of 1965 when this simulator project was initiated. Author (ESRO)

N69-16068# Brookhaven National Lab., Upton, N. Y.
AN ENRICHED PARTICLE BEAM USING SUPERCONDUCTING rf DEFLECTORS
H. N. Brown 1968 20 p refs Presented at the Summer Study on Superconducting Devices and Accelerators, Upton, N. Y. 10 Jun.-19 Jul. 1968 Sponsored by AEC
(BNL-12937) Avail: CFSTI

A two-cavity superconducting rf beam separator for use at the Brookhaven AGS is described. The separator is designed to produce separated or at least enriched secondary beams for use in counter experiments. Source emittance definition, angular separation, purification, and beam matching to detector are discussed. NSA

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-15062 Purdue Univ., Lafayette, Ind.
DYNAMICS OF A GAS ABSORPTION COLUMN
Noel Edward Moore (Ph.D. Thesis) 1967 176 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-6333

A model of a small bubble-cap absorption column, suitable for use in process control work was made. Experimental measurements were made, for the system air-sulfur dioxide-water, using an eight-inch bubble-cap column. The input and output variables considered were gas concentration, liquid concentration, gas flow rate, and liquid flow rate. The relationship of each output variable to each input variable was determined based on experimental data obtained from the study of just one plate. Another model, called the analytical model, was developed by a more conventional analysis of the unsteady-state material balance equation augmented by considerations of equilibrium, efficiency, liquid dynamics, and mixing on a plate. The two models developed were used to simulate a one-plate column and the results were compared with the experimental results and with the results of model developed by one of the previous investigators. In every case, the matrix model provided the best fit with the experimental data. Dissert. Abstr.

N69-15063 Oklahoma State Univ., Stillwater.
BUBBLE DYNAMICS IN LIQUID NITROGEN
Hudy Creel Hewitt, Jr. (Ph.D. Thesis) 1967 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-8420

The applicability of theoretical bubble dynamics solutions to vapor bubbles in liquid nitrogen was studied. The emphasis was on experimentally determining bubble behavior. Vapor bubbles in liquid nitrogen were photographed, using a Wollensak fastax camera, for three different liquid conditions: (1) superheated liquid with constant liquid pressure, (2) subcooled liquid with constant liquid pressure, (3) initially subcooled liquid with transient liquid pressure. The photographs were used to determine bubble radius-time histories, and these measurements were compared to the bubble radius predicted by theoretical equations. This study was conducted to include the effect of the earth's gravitational field on bubble motion. Vapor bubbles in liquid nitrogen were found to behave quite similarly to vapor bubbles in non-cryogens. Bubble growth in superheated liquid nitrogen was predicted, with less than twenty-two percent deviation for all data. Dissert. Abstr.

N69-15088# Wisconsin Univ., Madison. Mathematics Research Center.
SIMILARITY ANALYSES OF COMPRESSIBLE BOUNDARY LAYER FLOWS VIA GROUP THEORY
R. A. Gaggioli and M. J. Moran Dec. 1967 22 p
(Contract DA-31-124-ARO(D)-462)
(AD-674457; MRC-TSR-838) Avail: CFSTI CSCL 20/4

Based upon methods developed by Michal, Morgan, Birkhoff, and the present authors, the utility of mathematical groups of transformations for the purpose of achieving a reduction in the number of independent variables in a particular class of two dimensional, unsteady, compressible boundary layer flows is further investigated. In particular, previous presentations due to Gabbert, Ames, and Manohar are discussed, clarified, and extended. Author (TAB)

N69-15109 Houston Univ., Tex.
PROTUBERANCES IN VELOCITY-GRADIENT FLOW
Ernest Leon Dunning (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-7856

An experimental investigation of circular-cylindrical protuberances of finite length extending into fully-developed turbulent channel flow ($9.3 \times 10^3 \leq N_{Re} \leq 8.9 \times 10^4$) is presented. Three protuberance specimens were tested with length-to-diameter ratios of 5/3, 5/4, and 5/6. The investigation established the secondary flow characteristics in the region near the protuberance and the pressure distribution on the protuberance surface. Results indicate that secondary flow developed about the protuberance with components of flow both up and down the forward radial surface of the protuberance and with an upward component on the rear radial surface. The magnitude of the velocities of these secondary flows is established. Generally, the secondary flow characteristics are similar for all three protuberances and the Reynolds number dependency for the flow rates investigated was not substantial. A reverse (up-stream) secondary flow occurred immediately forward of the protuberance near the floor of the channel; the size of this region is dependent on Reynolds numbers.
Dissert. Abstr.

N69-15110 Oklahoma State Univ., Stillwater.
A NUMERICAL SOLUTION FOR THE FLOW FIELD OF A SUPERSONIC CONE-CYLINDER ENTERING AND LEAVING A BLAST SPHERE DIAMETRICALLY
Roger Ralph Eaton (Ph.D. Thesis) 1967 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-8396

An analysis was performed to develop a method by which the flow field about a cone-cylinder configuration could be found as it entered into and exited from a large radius spherical blast. Ideal gas and real gas in equilibrium were considered. The flow was approximated by solving the momentum, energy, and continuity partial differential equations using a numerical technique. Results were obtained for a projectile which entered and then exited from a blast front. Both fronts had a shock strength of 22.05 (i.e., pressure ratio). The free stream Mach number for the various phases ranged from 1.7 to 6.9. It was found that the flow in question could be approximated by this numerical technique, even though the accuracy of the results decreased as the free stream Mach number increased. The decrease in accuracy may be attributed to the manner in which the stagnation point was treated.
Dissert. Abstr.

N69-15122 Wisconsin Univ., Madison.
FAST MODEL CONTHOLLER FOR A HYDROFOIL CRAFT
Thomas Avolt Kanneman (Ph.D. Thesis) 1967 537 p
Avail: Univ. Microfilms: HC $24.30/Microfilm $8.65 Order No. 67-12437

This thesis is concerned with the study of a quasi-time-optimal control technique known as the fast-model control method and the application of this technique for longitudinal incidence control of a hydrofoil-supported craft. The fast-model control method is a form of predictive control in which repeated estimates of the future error are obtained by predicting ahead at high repetitive rate the reference input and the controlled variable. The fast-time predictor for the controlled process is based on an analog computer model of the controlled process, operated repetitively at approximately 100 times real-time. The fast-time predictor for the reference signal must be constructed based on actual measurements of the input signal.
Dissert. Abstr.

N69-15148 Michigan Univ., Ann Arbor.
SUBSONIC SPHERE DRAG MEASUREMENTS AT INTERMEDIATE REYNOLDS NUMBERS
Kenneth Robert Sivier (Ph.D. Thesis) 1967 248 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-7729

This research was concerned with the experimental study of the drag of smooth and rough spheres at subsonic Mach numbers, Reynolds numbers from 25 to 4000, and free-stream turbulence intensities up to 6%; flow conditions representative of part of the gasdynamic flow regime experienced by spherical particles occurring in the exhaust of rocket motors using metallized fuels. Sphere drag data under these conditions (which are generally very different from the conditions corresponding to standard sphere drag data) are scarce and difficult to obtain. Using the average outside diameter of a very rough sphere as the reference dimension, it was found that large scale surface roughness (ratio of roughness element size to sphere diameter in the range from 0.10 to 0.18) caused a small reduction in sphere drag for $Re < 500$ relative to the smooth sphere results. For $Re > 500$, large roughness was found to result in a systematic increase in C_D; the increase apparently correlating with ratio of the roughness element size to the boundary layer thickness.
Dissert. Abstr.

N69-15150 Minnesota Univ., Minneapolis.
THE EFFECT OF TURBULENCE PARAMETERS AND SUPPORT POSITION ON THE HEAT TRANSFER FROM, AND FLOW AROUND, SPHERES
George Douglas Raithby (Ph.D. Thesis) 1967 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-7370

A flow visualization study was conducted to determine the influence of the position of the sphere support on the flow pattern near the sphere surface. It was shown that, especially when a supercritical flow pattern existed around the sphere, a crossflow support substantially altered the flow pattern. A rear support lead to a much more symmetrical flow near the surface of the sphere. The location of separation on the surface of a sphere in a low turbulence stream was measured for Reynolds numbers ranging from subcritical to supercritical values. These measurements were repeated at higher values of the turbulence intensity (0.021 and 0.038). It was found that at subcritical Reynolds numbers, separation occurred at about 81 degrees from the stagnation point; at supercritical Reynolds numbers separation occurred at about 102 degrees. The effect of the increased turbulence intensity was to produce an earlier, and more gradual, transition from a subcritical to a supercritical flow pattern.
Dissert. Abstr.

N69-15319# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
FLOW OF SINGLE CYLINDRICAL GAS BUBBLES IN VERTICAL CIRCULAR TUBES [UEBER DIE STROEMUNG EINZELNER ZYLINDERFOERMIGER GASBLASEN IN VERTIKALEN KREISROHREN]
Dimitris Kouremenos (Ph.D. Thesis) 1967 123 p refs In GERMAN *Its* Dissertation No. 3939
Avail: CFSTI

The two phase flow of cylindrical air bubbles in a vertical pipe stream was studied by measurements on pressure gradients and wall friction velocity as well as calculations for bubble shape, bubble skin thickness, and friction. It was found that the pressure differences caused by traveling air bubble were 10 to 32% larger than comparable values for similar immovable gas volumes. Increased bubble viscosity increased also skin thickness and pressure differences.
G.G.

N69-15323# Eidgenoessische Technische Hochschule, Zurich (Switzerland).
REPORT ON THE COMPUTATION OF ISOTROPIC ONE DIMENSIONAL INTERMITTEN GAS FLOWS WITH THE HELP OF DIGITAL COMPUTERS [BEITRAG ZUR BERECH-

NUNG ISENTROPER EINDIMENSIONAL-INSTATIONAERER GASSTROEMUNGEN MIT HILFE VON DIGITALCOM-PUTERN]

Juerg Schatzmann (Ph.D. Thesis) 1968 111 p refs In GERMAN *Its* Dissertation No. 3928
Avail: CFSTI

Developed is an ALGOL computer program for calculating the thermodynamic properties of isentropic stationary gas flow in piston engines with gas dynamic pressure exchange. A matrix method is used to find numerical solutions for flow differential equations by substituting compression shock equations with steep pressure rise gradients. G.G.

N69-15355# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
AN EXPERIMENTAL INVESTIGATION OF BOILING CHANNEL FLOW INSTABILITY

Donald F. D'Arcy Aug. 1968 61 p Presented at the Symp. on the Dyn. of Two Phase Flow, Eindhoven, Neth.
(AECL-2733; CONF-670912-4) Avail: CFSTI

Experiments were conducted for the purpose of examining the threshold and nature of flow oscillations in parallel boiling flow channels. The test section comprised three internally heated annular flow channels connected via unheated pipes to inlet and outlet headers. The fluid was water at 500 to 1050 psi in forced circulation. The three heaters could be controlled independently up to 15 kW per foot each. The flow channels were vertical with 10 ft heated length. Mass fluxes up to about 10^6 lb/ft^2 hr could be achieved in the test section. Tests were performed by setting inlet subcooling and mass flux, then increasing power until either oscillating flow or dryout was observed. The range of inlet subcoolings was 15° to 150°F. Stability threshold data are presented for the basic geometrical configuration at about 1050, 850, and 550 psia. The effects of varying the channel equivalent diameter, heat flux distribution, inlet throttling, and number of heated and unheated channels were investigated. In addition to threshold data, the oscillation frequency and wave shape were recorded. Author (NSA)

N69-15367 West Virginia Univ., Morgantown.
SENSITIVITY ANALYSIS IN OPTIMUM PROCESS DESIGN

Tai Ming Chang (Ph.D. Thesis) 1967 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8338

The effects of parameter variation and uncertainty on optimal process design have been studied. Equations necessary for determining the sensitivity of optimal system performance to parameter variation are derived. Design criteria have been developed for optimal design of systems that are either sensitive to parameter variation or involving parameter uncertainty. The sensitivity equations for systems described by algebraic, differential and difference equations are derived based on the Lagrange multiplier method, Pontryagin's maximum principle and the discrete version of the maximum principle, respectively. Such sensitivity equations are linear and can be solved for sensitivity coefficients. Two methods are proposed for optimal design of parameter-sensitive systems. Two design criteria are proposed for optimal design of systems involving parameter uncertainty. Dissert. Abstr.

N69-15370*# IIT Research Inst., Chicago, Ill. Dept. of Mechanical and Aerospace Engineering.
LAMINAR MIXING OF HETEROGENEOUS AXISYMMETRIC COAXIAL CONFINED JETS Final Report

Kirti N. Ghia, T. Paul Torda, and Zalman Lavan Nov. 1968 188 p refs
(Grant NsG-694)
(NASA-CR-72480) Avail: CFSTI CSCL 20D

A binary isothermal system of non-reacting gases was considered, with the central jet consisting of a slow moving heavy gas and the coflowing annular stream consisting of a fast moving light gas. Results are applicable to the hydrodynamics of the coaxial flow gas-core nuclear reactor. Boundary layer equations in cylindrical coordinates were used to formulate the mathematical model and were transformed to the von Mises plane for numerical stability, and further to the ϕ-z plane to obtain a better representation of the flow problem in the central region. The solution was obtained by an explicit finite difference scheme. The numerical method developed was also used to generate the solution for the classical entrance flow problem, and the agreement of this solution with the available solutions provided a verification of the method. Partial check for the confined jet mixing problem was also obtained by comparing the numerical values of the fully developed flow parameters with the corresponding asymptotic values computed independently from simple theoretical considerations. Author

N69-15371*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
EMPIRICAL CHARACTERIZATION OF SOME PRESSURE WAVE SHAPES IN STRONG TRAVELING TRANSVERSE ACOUSTIC MODES

Marcus F. Heidmann Washington NASA Jan. 1969 12 p refs
(NASA-TM-X-1716) Avail: CFSTI CSCL 20D

Pressure wave shapes measured at the wall of a short cylindrical cavity containing a relatively pure traveling transverse acoustic mode were evaluated for harmonic content. The empirical relation $p' = \epsilon \cos t + \epsilon^2 \cos 2t + \epsilon^3 \cos 3t + \ldots$ was found to adequately represent wave shapes for peak-to-peak pressure amplitudes approaching the mean cavity pressure. The relation is relatively simple and provides a convenient method of characterizing strong wave shapes for many analytical and experimental purposes. Author

N69-15377#
DIFFERENCE METHODS OF COMPUTING FLOW IN THE BOUNDARY LAYER (SURVEY)

V. M. Paskonov et al [1968] 20 p refs Transl. into ENGLISH from Vychisl. Metody i Programmirovanie (Moscow), no. 11, 1968 p 55–74
Avail: CFSTI

Difference methods for numerical solution of fundamental equations of boundary layer theory are presented. These methods include application of 1) explicit and implicit schemes to compute two dimensional boundary layer flows; 2) schemes to compute two dimensional nonstationary flows; and 3) schemes for computing three dimensional flows. Author

N69-15386*# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
FUNDAMENTAL STUDY IN LOW-DENSITY GAS DYNAMICS Progress Report, 1 Nov. 1967–1 Nov. 1968

M. W. Milligan and H. J. Wilkerson 1 Dec. 1968 52 p refs
(Grant NGR-43-001-023)
(NASA-CR-99082; AE-68-023-4) Avail: CFSTI CSCL 20D

An outline of the progress on a theoretical and experimental investigation of rarefied, internal gas dynamics is presented. The activities are concerned with three different topics of rarefied gas flow: (1) a progress report primarily concerned with efforts to investigate rarefied, annuli flow with a rotating inner boundary; (2) an analytical solution for flow in an eccentric annulus with slip boundary conditions. A comparison with previously reported experimental data is made; and (3) the results of an investigation of rarefied gas flow through ultra fine filtering media. Author

N69-15439# Iowa Univ., Iowa City. Inst. of Hydraulic Research.
ON THE DISTRIBUTION AND DEVELOPMENT OF MEAN-FLOW AND TURBULENCE CHARACTERISTICS IN JET AND WAKE FLOWS
Eduard Naudascher Aug. 1968 40 p refs
(Contract Nonr-1611(03))
(AD-677367; IIHR-110) Avail: CFSTI CSCL 20/4

The lateral distributions of various mean-flow and turbulence characteristics, as obtained from measurements in axisymmetric jets and wakes, are shown to conform to a new concept of self-preservation. The development downstream from the flow origin of representative cross-sectional values of the turbulence shear stress, turbulence normal stress, and the maximum mean-velocity difference, as well as the development of some nondimensional ratios thereof, is presented for the following free-turbulence flows: plane free jets and wall jets with ambiant streams, axisymmetric jets in coaxial streams with different ratios of jet to free-stream velocity, and wakes behind a slender spheroid, a disk, a square plate, and a self-propelled body of revolution. The results indicate that in the case of axisymmetric free-shear flows, similarity according to the conventional definition is not even approached asymptotically and that the conditions of flow generation have a greater influence on the downstream flow development than has been assumed previously. Author (TAB)

N69-15443 Oklahoma State Univ., Stillwater.
A TECHNIQUE FOR STUDYING INTERACTIONS BETWEEN A SUPERSONIC BODY AND BLAST WAVES APPROACHING OBLIQUELY
Rusi Jal Damkevala (Ph.D. Thesis) 1967 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-8386

A technique was developed for studying the oblique shock-on-shock interactions between a rifle-launched model and a cylindrical shock wave from a shock tube. A sufficient number of photographs of adequate quality were obtained so that whole sequences of events at three selected shock strengths and model Mach numbers could be studied. The model used for all the tests was a 19.5° cone-cylinder, the cylinder being 0.375" in diameter. For a model at Mach 3.95, estimates based on the measured shock angles show that the pressure on the surface of the conical forebody after interaction is about 50 times the pressure there before interaction. Dissert. Abstr.

N69-15473*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
OBSERVATIONS OF INTERFACE BEHAVIOR DURING INFLOW TO AN ELLIPTICAL ENDED CYLINDER IN WEIGHTLESSNESS
Eugene P. Symons and Ralph C. Nussle Washington Jan. 1969 17 p refs
(NASA-TM-X-1719) Avail: CFSTI CSCL 20D

An experimental investigation was conducted during which liquid was pumped into a 4-cm-diameter cylindrical tank, initially void of liquid, in a weightless environment. The tank bottom, an inverted ellipse, was scaled from the Centaur propellant tank, as was the inlet line location. Three inlet diameters (0.2, 0.4, and 0.6 cm) were studied. The liquid–vapor interface during inflow became increasingly distorted as inflow velocity was increased. Furthermore, any increase in the ratio of inlet diameter to tank diameter necessitates lowering of inlet velocity to maintain a stable liquid–vapor interface. Author

N69-15541# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATIGATION OF THE UNSTEADY FLOW AROUND BODIES BY A CURRENT MOVING BEHIND A SHOCK WAVE
K. Ye Bogoslovskiy 15 Dec. 1967 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (USSR) no. 3, 1966 p 24-30
(AD-678392; FTD-HT-23-1155-67) Avail: CFSTI CSCL 20/4

The results of an experimental investigation of unsteady supersonic flow past cylinders are presented. The purpose of the experiment was to determine the basic criteria characterizing an unsteady flow behind a two-dimensional shock wave having constant time parameters and to ascertain the correlation between the variable location of a reflected shock wave and the surface pressure on the body. The experiments were carried out by subjecting cylinders with flat and spherical bluntness to axisymmetrical and transverse flows in a shock tube. The range of the Mach numbers of the incident shock waves was from 1.5 to 6. The magnitudes of maximum shock detachment distance at the stagnation point obtained were compared with available data and were found to be in good agreement. Author (TAB)

N69-15598#
COMPRESSIBLE VISCOUS GAS MOTION IN THIN TRANSITION LAYERS
G. L. Komissarova et al [1968] 4 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 12, 1967 p 1115-1118
Avail: CFSTI

Equations are derived which describe the processes taking place in the combustion zone of a flame front. The Navier–Stokes equations were used to investigate these processes, assuming the width of the transition zone to be greater than the mean free path of the molecules and the flow to be two dimensional. B.P.

N69-15617# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
THE STABILITY OF PLANE BLAST WAVES
Richard Gerwin and Richard B. Hall Oct. 1968 62 p refs
(D1-82-0765) Avail: Issuing Activity

The stability of a plane blast wave to surface perturbations is examined. It is found possible by making a "thin" sheet approximation to the geometry, to obtain a set of ordinary differential equations which describe the sheet motion. These equations are effectively solved for all possible initial conditions. It is found that surface perturbations grow rapidly at first but are eventually limited in amplitude. All perturbations grow in amplitude like powers of time. Author

N69-15620#
SELF-SIMILAR MOTIONS OF A GAS HEATED BY NONEQUILIBRIUM RADIATION OF COMPLEX SPECTRUM
V. M. Krol' et al [1968] 9 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 5, 1968 p 32-37
Avail: CFSTI

Motion of solid vapors, formed during evaporation by radiation and heated by this radiation to a temperature T exceeding the phase transition temperature T_v and the ionization temperature T_i, is considered. In this case the quantities T_v and T_i (equivalent to the heat of evaporation Q_v and the heat Q_i expended in ionization) can be neglected. The vapor density ρ is considerably lower than the density of the solid ρ_0 because of their dissipation. Therefore, it was assumed that the heating wave moves in an absolutely cold and infinitely dense gas. The vapor temperature is considered to be sufficiently low so that reradiation can be neglected. The coefficient χ of radiation absorption by the ionized vapors in a definite range of T, ρ and quantum energy ε was described by a power function of T, ρ. In this case the problem of gas motion is self-similar. The spectrum and angular distribution of the incident radiation ($\varphi(\varepsilon, \theta)$) and the dependence of χ on ε may be arbitrary. A system of ordinary differential equation is written down, and its solution is carried out. Author

N69-15626 Michigan Univ., Ann Arbor.
MOMENTUM TRANSFER IN A TURBULENT CONICAL CONFINED JET
George William Bowling (Ph.D. Thesis) 1967 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-7566

A jet flow involving two streams of water is investigated. The primary or high-velocity stream is fully developed turbulent flow in a tube. The secondary stream is also turbulent and the flow is confined by a conical wall with the primary stream along the axis of the cone. The conical confining wall is truncated by a cylinder which forms the mixing tube down-stream of the mixing nozzle. The Reynolds number of the primary stream is 25,000 and 50,000 and the mass-flowrate ratio of the two streams is varied between 0 and 2.25. The position of the primary stream nozzle is varied between 0 and 4 radii of the primary nozzle from the entrance to the mixing tube. Measurements include velocity profiles, static pressures and momentum integrals along the axis of the system as well as photographs of dye injections. Dissert. Abstr.

N69-15630*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ANALYSIS OF THE STABILITY OF A THIN LIQUID FILM ADJACENT TO A HIGH-SPEED GAS STREAM
Philip R. Nachtsheim Washington Jan. 1969 34 p refs
(NASA-TN-D-4976) Avail: CFSTI CSCL 20D

Oblique wave formation in the melt layer of a body entering the atmosphere is examined. The three-dimensional disturbance equations of the liquid including the effects of viscosity are formulated. The disturbance motion of the gas is taken into account neglecting viscosity. The Tollmien–Schlichting type of instability in the liquid is excluded and only those modes are considered for which the phase velocity of the disturbance is greater than the velocity of the basic liquid flow at the gas-liquid interface. Numerical and approximate analytic results are presented for waves in the liquid with supersonic flow over their crests. A comparison with the numerical solutions shows that the approximate analytic solutions are accurate for solving the eigenvalue problem when the Reynolds number of the liquid film is small, that is, for a highly viscous melt layer. The approximate solutions are obtained in closed form. It is demonstrated that the mechanism of liquid wave generation is supersonic wave drag. The relation between the wavelength of the disturbance and the other parameters involved in the eigenvalue problem is determined and is presented for a wide range of these parameters. Author

N69-15631*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
PRELIMINARY INVESTIGATION OF MOMENTUM DIFFUSION BETWEEN TWO SUPERSONIC AIRSTREAMS IN THE PRESENCE OF SHOCK WAVES
John P. Weidner and Carl A. Trexler Washington Jan. 1969 79 p refs
(NASA-TN-D-4974) Avail: CFSTI CSCL 20D

An experimental study of compressible two-dimensional mixing between two parallel supersonic airstreams passing through oblique shock waves has been performed, and the results have been compared with those of a computerized theoretical method. This experiment was restricted to measurements of momentum diffusion in the near region, with the purpose of the study being to determine the effect of the oblique shock waves on mixing. The model consisted of a two-dimensional rectangular duct mounted in a Mach 4 airstream operating at ambient temperature. The Mach 4 stream was the primary air through the duct, while the secondary air was injected at a higher total pressure and Mach number through three isentropic nozzles set into the bottom surface of the duct. The nozzles were oriented at such an angle relative to the primary stream as to create a set of shock waves each having a turning angle of about 6.0°. Total pressure measurements were taken across the mixing zone at several stations on either side of two crossing shock waves and were reduced to velocity profiles through the mixing zone. Average Mach numbers measured in the two streams were 3.5 and 4.4 ahead of the shock waves and 2.9 and 3.7 behind the shock waves. The theoretical solution indicated an increase in eddy viscosity in the vicinity of the shock waves. Author

N69-15650*# Applicazioni e Richerche Scientifiche, Milan (Italy).
THE TRANSITION REGIME OF RAREFIED GAS DYNAMICS Final Scientific Report, 1 May. 1965–3 Jul. 1968
Carlo Cercignani 31 Jul. 1968 13 p refs
(Contract AF 61(052)-881)
(AD-677342; AFOSR-68-2315) Avail: CFSTI CSCL 20/4

This report summarizes the work done in the field of rarefied gas dynamics under contract with A.F.O.S.R.. The report essentially consists of a list of the research papers prepared for publication from 1 May 1965 to 31 July 1968; for each paper the full title and an abstract is given, together with the proper reference. This list comprises 25 papers, mainly devoted to the study of specific problems of flows in the transitions regime, i.e., in that regime of rarefaction where the mean free path is of the same order of magnitude as a characteristic length. The main original contributions range from the suggestion of new methods of solution for the Boltzmann equation to the detailed treatment of specific problems of particular interest, such as the Poiseuille and Couette flows in different geometries, flow past an axisymmetric obstacle, influence of the wall accomodation properties on the results of the above problems. Author (TAB)

N69-15669*# Aztec School of Languages, Inc., Acton, Mass.
DISTRIBUTION OF FLOW RATE IN A RECTANGULAR PIPE, LONG SIDE SECTION ARRANGEMENT IN A CROSSED MAGNETIC FIELD [RASPREDELENIYE SKOROSTEY TECHENIYA V PRYAMOUGOL'NOY TRUBE, RASPOLOZHENNOY DLINNOY STORONOY SECHENIYA VDOL'MAHNITNOGO POLYA]
G. G. Branover et al Washington NASA Dec. 1968 5 p refs Transl. into ENGLISH from Magnitn. Gidrodinam., Akad. Nauk Latv. SSR (Riga), v. 4, 1968 p 65–67
(Contract NASw-1692)
(NASA-TT-F-12009) Avail: CFSTI CSCL 20D

The results of calculations on an electronic computer for the distribution of flow rate in rectangular pipes with a low side-section ratio placed in a transverse magnetic field are presented on the basis of Sherkliff's precise solution for a laminar flow regime. The authors' experimental data on the effect of a transverse magnetic field on the flow rate of the conducting fluid (mercury) at the center of a pipe with a side-section ratio of $\beta = 0.133$ are also presented. It is established that the results of the experiment, both for the turbulent range and for the range of the laminated flow, agree well with the semi-empirical theory and the precise solution. Author

N69-15672*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SHOCKLESS GAS FLOW IN A LAVAL NOZZLE [BEZUDARNOYE TECHENIYE GAZA V SOPLE LAVALYA]
V. B. Gorskiy 29 Nov. 1967 38 p refs Transl. into ENGLISH from Saratov. Transzvukovyy Techeniya Gaza., Sb. Statey (USSR), 1964 p 22–62
(AD-678470; FTD-HT-23-1018-67) Avail: CFSTI CSCL 20/4

A plane, steady, laminar, and adiabatic flow of an ideal gas in a Laval nozzle is studied. Such a flow is described by the Chaplygin equation for any practical important distance from the sound line. The Chaplygin equation is sought as an infinite series in which the first member is the Tricomi equation. Unlike the straight problem in the nozzle, when for the given walls the flow

inside it is sought. A semireverse problem has to be solved the distribution of gas velocity passing beyond the speed of sound along the axis of symmetry, considered as the zero line of the flow in the form of an analytical function from the coordinate. The flow outside the axis is sought. Two fixed lines of the flow are assumed as the walls of nozzle. Author (TAB)

N69-15699*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STUDY OF THE ACCURACY OF GAS FLOW MEASUREMENTS USING THE SONIC THROAT METHOD [ETUDE DE LA PRECISION DES MESURES DE DEBITS GAZEUX PAR LA METHODE DU COL SONIQUE]
Bernard Masure 10 May 1968 21 p refs Transl. into ENGLISH from French Presented at Assoc. Tech. Maritime et Aeron., Paris, 6–10 May 1968
(Contract NAS7-100)
(NASA-CR-99127; ONERA-TP-572) Avail: CFSTI CSCL 20D

The formula leading to a calculation of a gas flow using the sonic throat method is recalled. This relationship, which is deduced from the monodimensional theory and is applied to the flow of a gas without viscosity and constant specific heat, must be affected by three corrective factors. These three factors are analyzed in succession in the case of air curvature of the sonic line, viscosity, effect of compressibility. Some experiments are described which confirm the calculation of the compressibility effect. Author

N69-15706# Eidgenossische Technische Hochschule, Zurich (Switzerland).
INFLUENCE OF VARIOUS PARAMETERS ON THE DELAY TIME DISTRIBUTION IN A REACTION FLOW PIPE [EINFLUSS VERSCHIEDENER PARAMETER AUF DIE VERWEILZEITVERTEILUNG IN EINEM STROEMUNGSROHR]
Emilio Salami (Ph.D. Thesis) 1968 107 p refs In GERMAN *Its* Dissertation No. 4002
Avail: CFSTI

Conductometric data in form of E curves were obtained on the flow of a liquid through reaction pipes having knees. The liquid contained small amounts of a marker substance. The resulting E curves were evaluated by means of a diffusion model and the method of Taylor. A comparison of experimental results with the theoretically determined concentration curves shows good agreement in the upper half and considerable deviation in the last part, where a decrease of the first order occurs. The dispersion coefficient in the flow pipe in the turbulent region was represented as a function of Reynolds number, reduced pipe length, volumetric portion of the pipe's knees, and a factor for the geometry of the knees. An increase in the axial dispersion coefficient with increasing pipe length was noted in all experiments. Contrary to commonly accepted views, a decrease in recurrent mixing was noted due to the formation of secondary currents by the knees. The effects of viscosity, pipe diameter, temperature, and insertion of spirals into the pipes were taken into account and are briefly discussed. K.W.

N69-15820# New York Univ., N. Y. Geophysical Sciences Lab.
FORMULATION OF CONSTITUTIVE EQUATIONS FOR TURBULENT MIXING
A. D. Kirwan Sep. 1968 25 p refs
(Contract Nonr-285(57))
(AD-678417; TR68-12) Avail: CFSTI CSCL 20/4

The paper examines the problem of describing turbulent fluxes in terms of gradients of mean quantities. The formulation leans heavily on analogy with the development of constitutive equations for the molecular fluxes. Equations are derived for the turbulent fluxes of heat and momentum in a fluid in which mixing is isotropic along some prescribed surface. A turbulent entropy principle is employed to obtain inequalities for the eddy viscosities and diffusivities. Author (TAB)

N69-15825# National Center for Atmospheric Research, Boulder, Colo.
SHOCK WAVES FROM LINES SOURCES
Myron N. Plooster Nov. 1968 93 p refs
(NCAR-TN-37) Avail: Issuing Activity

The pressure wave arising from a sudden release of energy along a line in a gas initially at rest was studied by numerical integration of the equations of motion on a digital computer. The energy source was assumed to be infinitely long, so that the flow variables were functions only of a radial coordinate and the time. Computations were performed using both the ideal gas equation of state and an equation of state resembling that of real air at high temperatures. Several initial conditions, in which the distribution of both energy and mass at the instant of energy release was varied, were employed. The results are compared with asymptotic analytical solutions for both very strong and very weak cylindrical shock waves. For computations employing the ideal gas law, the shock wave strength in the strong shock region is directly dependent upon the gas density in the region of energy release. When the gas density is initially constant everywhere, shock overpressure curves (as a function of radius) converge rapidly upon the curves for the strong shock asymptotic solution. Author

N69-15858# Joint Publications Research Service, Washington, D. C.
THREE-DIMENSIONAL SUPERSONIC FLOW OVER A BLUNT BODY
V. V. Rusanov 6 Jan. 1969 33 p refs Transl. into ENGLISH from Zh. Vychislitel'noi Mat. i Mat. Fiz. (Moscow), no. 3, 1968 p 616–633
(JPRS-47180) Avail: CFSTI

An algorithm is proposed for calculating three dimensional flow around an arbitrary, blunt, smooth body both in the subsonic and in the supersonic regions. One specific difficulty in the general three dimensional problem is the singularity which appears on the axis of the cylindrical coordinate system. This leads to the necessity of formulating complex boundary conditions of the axis. It is shown that these complications can be avoided by introducing a Cartesian coordinate system close to the axis, for which there is no singularity. The difference system and the results of studying its stability are described. Results derived from calculating three dimensional flow around different bodies are included. Author

N69-15859# Joint Publications Research Service, Washington, D. C.
SUPERSONIC VISCOUS GAS FLOW NEAR STAGNATION LINE OF SPHERE AND CYLINDER
B. M. Pavlov 2 Jan. 1969 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk (Novosibirsk), no. 31, Mar. 1967 p 46–52
(JPRS-47171) Avail: CFSTI

Flow parameters are determined in the compressed layer of a steady uniform flow of a viscous heat conducting compressible gas approaching a sphere or circular cylinder. Navier–Stokes equations govern the flow parameters near the stagnation line. Two numerical solutions are presented: the local-similarity approximation without any other assumptions and a numerical method for calculating the two dimensional vicinity of a stagnation line. Common to both techniques was the use of the finite difference method and the use of the transient method for solving the boundary value problem. B.P.

N69-15863 Centre d'Etudes Aerodynamiques et Thermiques, Poitiers (France).
SOME RESULTS ON THE THREE DIMENSIONAL BOUNDARY LAYER [QUELQUES RESULTATS SUR LA COUCHE LIMITE TRIDIMENSIONNELLE]

J. F. Arnaudon and L. F. Tsen [1968] 26 p refs In FRENCH
Presented at AFITAE 5th Appl. Aerodyn. Colloq., Poitiers, France, 6-8 Nov. 1968
Avail: Issuing Activity

Three dimensional laminar boundary layer in compressible flow with and without heat transfer is studied. Supersonic blow down tunnels were used for this investigation. They were designed and suitably equipped for the study of heat transfer phenomena. Results are presented which were obtained on a cone at angle of attack at M=3.3. The study of the transversal flow, i.e. normal to the streamlines at the edge of the boundary layer, was emphasized, together with the influence of wall temperature and the determination of the separation point. The experimental results were compared with theoretical results obtained with an integral method that uses the linearized equation of transversal flow. This method is also illustrated by means of some examples of three dimensional boundary layer whose exact solution is known from other methods. Author

N69-15925# Western Co. of North America, Dallas, Tex. Research Div.
EFFECT OF WALL SHEAR STRESS ON DRAG REDUCTION OF VISCOELASTIC FLUIDS Final Report
Norman F. Whitsitt, Lawrence J. Harrington, and Horace R. Crawford Jun. 1968 72 p refs
(Contract Nonr-4306(00))
(AD-677467; DTMB-3) Avail: CFSTI CSCL 20/4

Drag-reducing flow tests were carried out over a wide range of polymer concentrations in flow sections ranging from 0.18 inch to 6.0 inches in diameter. The water-soluble polymers used in this study were Separan AP-30, a highly efficient drag reducer, and J2-FP, a guar-type, lower molecular weight, moderately efficient drag reducer. It was found that the critical shear stress at the inception of drag reduction, was independent of flow-section diameter (or boundary layer thickness). This critical shear stress was strongly dependent on polymer concentration for the highly efficient additive (AP-30). For the moderately efficient J2-FP, only a very slight dependence of critical shear stress on additive concentration was found. For a given concentration of a specific polymer, the drag reduction was found to be a unique function of wall shear stress. The high molecular-weight polymer solutions were found to exhibit a decreased percentage of drag reduction at the higher shear rates which the lower molecular weight polymer solutions did not. This lower percentage was attributed to the mechanical scission of the high molecular weight polymer by shearing action of the fluid. Author (TAB)

N69-15946# Stanford Univ., Calif. Thermosciences Div.
DIELECTROPHORESIS
James N. Castle Dec. 1967 106 p refs
(Grant NSF GK-1334)
(LG-5; PB-179533) Avail: CFSTI CSCL 20C

The equations of motion (similar to the Navier-Stoke's equations) are derived that describe the behavior of an incompressible dielectric fluid in an electric field. Dielectrophoresis is a general term used to denote motions brought about by the electric field. The pertinent Maxwell-Minkowski electromagnetic field and boundary conditions are formulated based on the physical properties of the dielectric, the electric field frequency, and the electric field strength. Close agreement between theory and experimental data indicates that an acceptable approach has been employed to study dielectrophoretic phenomena. Author (USGRDR)

N69-16041# Kansas State Univ., Manhattan. Dept. of Chemical Engineering
QUASILINEARIZATION TECHNIQUE FOR SOLUTION OF BOUNDARY LAYER EQUATIONS
E. S. Lee and L. T. Fan Repr. from Can. J. of Chem. Eng. (Ottawa), v. 46, Jun. 1968 p 200-204 refs
(Grant AF-AFOSR-68-1410)
(AD-677686; AFOSR-68-2407) Avail: CFSTI CSCL 20/4

There arise many difficulties in solving numerically the nonlinear equations describing the boundary-layer flow owing to the split boundary conditions. It is shown in this paper that the quasilinearization technique is a useful tool for solving the ordinary differential equations, which are obtained from the boundary layer equations through a similarity transformation. With very approximate initial guesses, only four to six iterations are needed to obtain a five digit accuracy. Author (TAB)

N69-16076# Shell Development Co., Emeryville, Calif.
LINEARIZATION AND STANDARDIZATION OF GRAPHS. CONTROL OF A FACTORIAL ENUMERATION RELATED TO GRAPH ISOMORPHISM
F. G. Stockton Feb. 1968 54 p refs
(PB-179837; TPR-2-68) Avail: CFSTI CSCL 05B

Graphs are useful as abstract representations of physical and conceptual situations. Examples include chemical structures, piping and wiring diagrams, and process flow sheets. In some applications, when many graphs are to be stored and retrieved by an automatic mechanism, a recognition problem arises. In this report a method is elaborated for the reversible and unique encodement of a graph as a linear symbol string (like a name), suitable for processing for storage, classification, recognition, and retrieval purposes. The recognition problem was encountered in the design of an automated file for storage and retrieval of chemical structures and associated information. Solution of the recognition problem was essential for the chemical system, and the work reported here was motivated by that necessity. The principal problems encountered in this study relate to symmetry and to control of a factorially expanding enumeration. These difficulties arise in many computational contexts and may interest some not otherwise concerned with the main purpose of the investigation. Author (USGRDR)

N69-16093# Deutsche Versuchsanstalt Fuer Luft- und Raumfahrt, Aachen (West Germany). Inst. fuer Theoretische Gasdynamik.
ANALYTIC CALCULATION OF TWO-DIMENSIONAL SUPERSONIC JETS
W. Pokorny Oct. 1968 95 p refs In GERMAN
(DLR-FB-68-63) Avail: CFSTI

Two-dimensional supersonic jets are calculated applying an analytical method of characteristics. The use of acoustic theory in the characteristic plane leads to second order errors in the expansion zone of a jet exhausting into an underpressure region. By means of new assumptions different from the acoustic theory, these shortcomings can be avoided. Acoustic theory in the characteristic plane is again used to treat the interaction zone of the shocks of a supersonic jet exhausting into an overpressure region. Author

N69-16098*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
REAL-GAS EFFECTS IN CRITICAL FLOW THROUGH NOZZLES AND THERMODYNAMIC PROPERTIES OF NITROGEN AND HELIUM AT PRESSURES TO 300 TIMES 10^5 NEWTONS PER SQUARE METER (APPROX. 300 ATM)
Robert C. Johnson Washington 1968 204 p refs
(NASA-SP-3046) Avail: CFSTI CSCL 20D

A critical-flow factor for gaseous nitrogen and helium flowing through critical-flow nozzles was calculated. This factor provides a convenient means for determining the mass-flow rate of these gases through critical-flow nozzles. In addition, the results include the nozzle throat velocity, the compressibility factor, the entropy, the enthalpy, the specific heat, the specific-heat ratio, the speed of sound, and the critical pressure, density, and temperature ratios. These results are tabulated as functions of the plenum pressure

and temperature. The pressure range is 300 × 10^5 newtons per square meter (approx. 300 atm). For nitrogen, the temperature range is from 100° to 400°K. For helium, the range is from 15° to 400°K. The FORTRAN 4 subroutines used to calculate these results are also included. These routines permit three different sets of independent variables. In addition to the plenum pressure and temperature, the other independent variable is either the nozzle exit pressure, the nozzle exit Mach number, or the nozzle exit temperature. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-15051 Texas A&M Univ., College Station.
STREAMFLOW FORECASTING BASED ON STATISTICAL APPLICATIONS AND MEASUREMENTS MADE WITH RAIN GAGE AND WEATHER RADAR
Michael Dale Hudlow (Ph.D. Thesis) 1967 123 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-5000

Techniques for streamflow forecasting are developed and tested for the Little Washita River in Oklahoma to determine the possibility of utilizing weather radar and probabilistic simulation to obtain the rainfall input. Also, the feasibility of a radar, rain-gage combination is examined. It is shown that quantitative estimates of runoff can be made from measurements taken with weather radar. In addition, accurate estimates of lag time can be made from radar observations. A technique for hydrograph synthesis which utilizes the Pearson type III function is developed. Since this method is adaptable to the digital computer, the "time factor," which is so important for river forecasts, can be shortened. A stochastic model for rainfall-runoff simulation is developed. Monte Carlo techniques are coupled with the stochastic model to yield frequency histograms of hydrograph-peak discharges and corresponding lag times. Dissert. Abstr.

N69-15102 Pittsburgh Univ., Pa.
MAGNETOMECHANICAL BEHAVIOUR OF NICKEL, COBALT, AND MAGNETITE AND APPLICATION TO ROCK MAGNETISM
Robert Stewart Carmichael (Ph.D. Thesis) 1967 226 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-6189

Aspects of the relationship of external stress and localized internal stress to magnetic properties of multidomain materials were investigated. A model was developed for the observed structure-sensitive dependence of remanence, coercivity, and stability of magnetization. It is based upon the response of the magnetization, specifically a multi-domain configuration, to changes induced in the internal microstructure by mechanical deformation. Polycrystalline rods of ferromagnetic nickel and cobalt were subjected to torsional plastic deformation. It was found that mechanical hardening or softening is, in general, accompanied by corresponding magnetic hardening or softening. The magnetic effects accompanying reverse loading are particularly intimately related to changes in the internal stress state of the rods. Single crystals of ferrimagnetic magnetite were subjected to extensive uniaxial elastic deformation. The reversible and irreversible magnetic effects were again interpreted in terms of microscopic deformation processes such as the movement of dislocation defects. Dissert. Abstr.

N69-15220# California Univ., Livermore. Lawrence Radiation Lab.
POSTSHOT GEOLOGIC INVESTIGATIONS, PROJECT GASBUGGY
D. E. Rawson, J. A. Korver, R. L. Pritchard, and W. Martin 26 Sep. 1968 21 p refs Presented at the Soc. of Petrol. Engr. Meeting, Houston, Tex., 29 Sep. 1968 Supported by AEC
(UCRL-71354; PNE-G-11; CONF-680926-2) Avail: CFSTI

In the Gasbuggy experiment on nuclear stimulation of natural gas flow, the nominal 26-kt nuclear explosive was detonated on December 10, 1967, at a depth of 4240 ft, in the Lewis shale some 40 ft below its contact with the Pictured Cliffs gas-bearing formation. Postshot exploration of the chimney and the surrounding fractured region consisted of geophysical, chemical, and radiochemical investigations in the redrilled explosive emplacement hole (GB-E) and in the redrilled preshot hole GB-2, which was offset about 300 ft from the emplacement hole. Gas production testing was also done to assess in a preliminary way the effects of nuclear stimulation. The investigations of chimney size and extent of fracturing are reported. The Gasbuggy explosion produced a rubble-filled chimney about 80 ft in radius and 333 ft high. The reentry hole penetrated only the upper portion of the chimney which appears to consist of sagged and slumped rock strata, with a few rubble-filled voids. Author (NSA)

N69-15221# California Univ., Livermore. Lawrence Radiation Lab.
GAS QUALITY INVESTIGATION PROGRAM: PROJECT GASBUGGY Status Report
Charles F. Smith and Floyd F. Momyer 18 Sep. 1968 30 p Presented at the Soc. of Petro. Engr. Meeting, Houston, Tex., 29 Sep. 1968 Supported by AEC
(UCRL-71314-Rev-1; PNE-G-10; CONF-680926-1) Avail: CFSTI

Natural gas from the underground cavity produced by the Gasbuggy nuclear detonation was first sampled the day after the shot and has been monitored continuously since a month after the shot when the reentry drill hole penetrated the chimney. Results of chemical and radiochemical analyses of the gas are presented for the first seven months after the shot. At that time, 50 million ft^3 of the gas—including 30% of the amount originally in the chimney—was produced and flared in a 10-day period. Radiochemical evidence indicates that gas flowed rapidly into the chimney from the surrounding formation after the shot, as had been hoped. Preliminary evidence suggests that flaring the initial production of gas from the chimney may be a useful process for reducing the contamination level of the remainder of the gas. During the period on continuous monitoring between reentry and the production run, the major constituents of the cavity gas varied as follows: methane, increased from 37 to 44%; ethane, increased from 4 to 5%; propane, constant at about 1%; carbon dioxide, constant at about 36%; hydrogen, decreased from 17 to 12%; and carbon monoxide, decreased from 4 to less than 2%. Author (NSA)

N69-15228*# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
IMPROVED COEFFICIENTS OF THE THIRTEENTH ORDER HARMONICS OF THE GEOPOTENTIAL DERIVED FROM SATELLITE DOPPLER DATA AT THREE DIFFERENT ORBITAL INCLINATIONS
S. M. Yionoulis May 1968 14 p refs Sponsored in part by NASA
(Contract NOw-62-0604-c)
(NASA-CR-98915; AD-677271; TG-1003) Avail: CFSTI CSCL 08E

The paper gives the results of the determination of the coefficients associated with three odd degree harmonics of the geopotential of order thirteen. The opportunity to refine the values of these coefficients was made possible with the launching of the

GEOS-II (1968 02A) satellite. A brief description of the method used is also included in addition to references where more detailed information can be found. Author (TAB)

N69-15299# International Training Centre for Aerial Survey, Delft (Netherlands).
PRACTICAL APPLICATIONS OF AERIAL PHOTOGRAPHS IN FORESTRY AND OTHER VEGETATION STUDIES [APLICACIONES PRACTICAS DE LAS FOTOGRAFIAS AEREAS PARA LA SILVICULTURA Y OTROS ESTUDIOS DE VEGETACION]
D. A. Stellingwerf Mar. 1968 43 p refs In ENGLISH and SPANISH *Its* Publ., Ser. B, No. 47/48
Avail: CFSTI

Aerial stereographs illustrating several forest, crop, and soil conditions are presented and described. Both panchromatic and infrared films were used, along with various combinations of filters. N.E.N.

N69-15344# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BASIC CRITERIA DEFINING THE INTENSITY OF TURBULENCE IN A MOUNTAIN REGION [OSNOVNYYE KRITERII, OPREDELYAYUSHCHIYE INTENSIVNOST TURBULENTNOSTI V GORNOM RAYONE]
D. L. Laykhtman et al 29 Nov. 1967 11 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 171, 1965 p 32–37
(AD-678477; FTD-HT-23-1017-67) Avail: CFSTI CSCL 4/1

An effort is made to compute the characteristics of air currents in mountainous regions. The study avoids the use of an oversimplified terrain model such as one in which a mountain ridge is treated as a single obstacle of one form or another. The authors take the approach that the complex structure of an air stream in a mountainous area may be represented as a certain smoothed motion U upon which are superimposed macroscalar pulsations. These pulsations are the result of the current breakup upon incidence with the mountain ridge. Hence, the mountains are visualized as a lattice wherein the basic generation of turbulence energy occurs in a layer ranging from a certain mean height to the mountain summits. Above this layer the inflow of energy of turbulence is caused by the diffusion from below. Author (TAB)

N69-15391*# Brookhaven National Lab., Upton, N. Y.
THE RISE AND STABILITY OF THE EARTH'S ATMOSPHERE
Lloyd V. Berkner (Southwest Center for Adv. Studies) and Lauriston C. Marshall (Southern Ill. Univ.) Jun. 1968 10 p refs Revised *Its* Lecture Ser. No. 64
(Grants NsG-269; NSF GA-483; NSF GA-1290)
(NASA-CR-99117; BNL-50144) Avail: CFSTI CSCL 04A

The purpose of this lecture was to describe progress of the work that may lead to a general theory of planetary atmospheres of the terrestrial-type planets: Mars, Earth, Venus, and Mercury. The history and development of the terrestrial atmosphere are considered with special attention being given to the oxygen buildup. NSA

N69-15400*# GCA Technology Div., GCA Corp., Bedford, Mass.
STRUCTURE AND VARIABILITY OF EARTH'S ATMOSPHERE Final Report
R. A. Minzner and P. Morgenstern Nov. 1968 146 p refs
(Contract NASw-1463)
(NASA-CR-99040; GCA-TR-68-1-N) Avail: CFSTI CSCL 04A

Density-altitude profiles obtained from 437 rocket soundings for various portions of the altitude interval 30 to 200 km were statistically studied for variations associated with solar flux. The soundings were sorted into homogeneous cells of a three-dimensional array defined by specific diurnal, seasonal and latitudinal categories. Six diurnal categories are defined in terms of solar zenith angles and earth shadow heights, rather than in terms of standard or Greenwich time. Eight seasonal categories are defined in terms of standard or Greenwich time. Eight seasonal categories are defined in terms astronomical, as well as continental climatological considerations. Six latitude bands are defined in 15-degree increments with seasonal inversions to permit combining of southern and northern latitude regions. The quasi-homogeneous stratification of data permitted the examination of the influence of 10.7 cm solar flux radiation independent of the influence of each of the three variables mentioned above. The results of these various computations are presented as a portfolio of 92 altitude profiles of the coefficient of correlation between density and 10.7 cm solar flux. Author

N69-15525*# GCA Technology Div., GCA Corp., Bedford, Mass.
EXPERIMENTAL AND THEORETICAL STUDIES IN PLANETARY AERONOMY Quarterly Progress Report, 1 Sep.–30 Nov. 1968
F. F. Marmo Jan. 1969 90 p refs
(Contract NASw-1726)
(NASA-CR-99003; GCA-1-297-01; QPR-2) Avail: CFSTI CSCL 04A

Brief discussions on the summary of laboratory progress on selected planetary atmospheric gases include: (1) drift velocity measurements for atmospheric nitrogen ions; (2) laboratory measurements of VUV photon scattering cross sections for selected atmospheric gases; (3) VUV electron spectroscopy of NO, CO, and CO_2; and (4) absorption and photoionization cross section for $\lambda\lambda < 500$ Å. VUV photon scattering cross sections for hydrogen were calculated for $\lambda\lambda < 2500$ Å from experimental data on the oscillator strength distributions of molecular hydrogen, supplemented by refractive index data and sum rules. Work was completed on evaluating the feasibility of a Mars Lander Experiment designed to perform spectral photometric measurements of the Martian atmospheric day, twilight, and night airglows. It was demonstrated that the general background radiation applicable to the Martian airglow experiment is about two orders of magnitude less than that encountered on earth and furthermore, that the spectral range of investigation can be extended down to 2000 Å. B.P.

N69-15526# Joint Publications Research Service, Washington, D. C.
DETERMINING THE DIMENSIONS OF THE SUBSOLAR MAGNETOSPHERE ACCORDING TO THE DATA FROM TERRESTRIAL OBSERVATIONS OF GEOMAGNETIC MICROPULSATIONS
V. A. Troitskaya et al 10 Jan. 1969 8 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Ser. Mat., Fiz. (Moscow), v. 182, no. 5, 1968 p 1063–1066
(JPRS-47232) Avail: CFSTI

Among the variety of geomagnetic micropulsations, oscillations of the Pc 2–4 type, with the periods T = 10 to 150 seconds, are isolated which are observed practically continuously on the surface of the Earth turned toward the Sun. These are the natural hydromagnetic oscillations of the magnetosphere excited on its periphery by solar corpuscular fluxes. The period of the oscillations depends on the dimensions of the resonator, the "walls" of which are the surface of the Earth and the shockwave front which occurs when the solar wind flows around the magnetosphere and bounds the geomagnetic field on the subsolar side at a distance of 10 radii of the Earth on the average. Direct measurements of the magnetic field and particle fluxes by satellites and rockets indicate that the boundary of the magnetosphere is in constant motion, approaching the surface of the Earth on intensification of the solar wind and receding when the wind becomes weaker and the normal pressure on the surface of the magnetosphere decreases. Thus, micropulsations of the type mentioned can be considered as a simple terrestrial indicator permitting continuous tracking of the position of the boundary of the magnetosphere. B.P.

N69-15544*# Techtran Corp., Glen Burnie, Md.
CATALOG OF MEASURED AND CALCULATED VALUES OF THE STRESS MODULUS OF THE GEOMAGNETIC FIELD ALONG THE ORBIT OF THE COSMOS 49 SATELLITE. PART 1: FROM NO. 1 TO NO. 6205, 24 OCTOBER–4 NOVEMBER 1964
Sh. Sh. Dolginov et al 1968 23 p refs Transl. into ENGLISH from Russian
(Contract NAS5-14826)
(NASA-CR-99055) Avail: CFSTI CSCL 08N

The catalog of measured and calculated values of magnetic field intensity modulus along the orbit of the satellite Cosmos 49 contains 17,489 measurements performed during November of 1964. The catalog consists of three parts. In the first part a brief text is presented, describing the measurements themselves, their processing, certain results and the content of the numerical tables. The first portion includes 6205 measurements. The second and third portions include only a description of the content of the tables and the tables themselves. In the period from 24 October to 3 November 1964, measurements of the magnetic field of the earth were performed using absolute proton magnetometers in the Cosmos 49 satellite. These measurements were a part of the Soviet national program in the plan for world magnetic surveying.
Author

N69-15545*# Techtran Corp., Glen Burnie, Md.
CATALOG OF MEASURED AND CALCULATED VALUES OF GEOMAGNETIC FIELD INTENSITY MODULUS ALONG ORBIT OF SATELLITE COSMOS 49. PART 2: FROM NO. 6206 TO NO. 12336, 24 OCTOBER–4 NOVEMBER 1964
Sh. Sh. Dolginov et al [1968] 4 p Transl. into ENGLISH from Russian
(Contract NAS5-14826)
(NASA-CR-99007) Avail: CFSTI CSCL 08N
For abstract, see N69-15544

N69-15546*# Techtran Corp., Glen Burnie, Md.
CATALOG OF MEASURED AND CALCULATED VALUES OF GEOMAGNETIC FIELD INTENSITY MODULUS ALONG ORBIT OF SATELLITE COSMOS 49. PART 3: FROM NO. 12337 TO NO. 17489, 24 OCTOBER–4 NOVEMBER 1964
Sh. Sh. Dolginov et al [1968] 4 p Transl. into ENGLISH from Russian
(Contract NAS5-14826)
(NASA-CR-99005) Avail: CFSTI CSCL 08N
For abstract see N69-15544

N69-15722*# Kansas Univ., Lawrence. Remote Sensing Lab.
SCATTEROMETER DATA ANALYSIS TECHNIQUES
H. W. Masenthin Jul. 1967 19 p ref
(Contracts NAS9-7175; NSR-17-004-003)
(NASA-CR-99191; CRES-118-3) Avail: CFSTI CSCL 08E

This report discusses the use of scatterometry as a geoscience tool for discrimination and identification of terrain surfaces. The volume of data that must be interpreted in such an application makes it mandatory that a presentation technique be used that permits simultaneous scanning of multiple parameter data at a much faster rate than can be achieved with the normal scattering coefficient versus angle of incidence curves. Data analyzed to determine the ability of the scatterometer to discriminate various surfaces show a variety of presentations that might be considered for use by geoscience investigators.
Author

N69-15723*# California Inst. of Tech., Pasadena.
ALBEDO ELECTRONS BETWEEN 12 AND 1000 MeV
Martin H. Israel [1969] 36 p refs
(Grant NGL-05-002-007)
(NASA-CR-99192) Avail: CFSTI CSCL 04A

We measured the flux of splash albedo electrons near Fort Churchill, Manitoba, on 9 July 1967. A directional electron detector, consisting of a scintillation-counter telescope, a gas Cerenkov counter, and a spark chamber with lead plates, was flown on a balloon near 2 g/cm^2 atmospheric depth and pointed toward the nadir. We observed fluxes of 94 ± 16, 47 ± 11, 27 ± 9, and 2^{+4}_{-2} electrons/m^2 sec sr in the energy intervals 12-50, 50-100, 100-350, and 350-1000 Mev, respectively. We also observed return albedo electrons near Palestine, Texas, in a balloon flight near 5 g/cm^2 atmospheric depth on 7 April 1967. Between 25 and 65 Mev we find 60 ± 26 return-albedo-electrons/m^2 sec sr. At higher energies the observed flux of downward moving electrons is consistent with being atmospheric secondaries; These return albedo fluxes are significantly lower than corresponding fluxes previously reported by Verma but are consistent with results of a calculation by Bland. Comparison between our observations at Fort Churchill and those at Palestine indicate a significant contribution to the splash albedo flux from primary particles with rigidity below 4.5 GV.
Author

N69-15808# International Consultant Scientists Corp., Brooklins, Mass.
THE TORNADO SIGNAL [LE SIGNAL DE LA TROMBE]
John Carstoiu [1968] 5 p refs In FRENCH Submitted for publication
Avail: Issuing Activity

A hypothetical comparison is made between causative phenomena producing a waterspout or working a divining rod. It is assumed that the waterspout is released by a cloud created magnetism and that the earth exerts a certain influence on these clouds which are in a state of unstable equilibrium. A small, local irregularity of the terrestrial magnetic field can initiate the lowering of the strongly charged electric cloud; the instability begins. The cloud then begins to rotate complying with electromagnetic forces. Mathematical expressions are derived for the above hypothesis, and include descriptions for magnetic charge density, magnetic conductivity, and the current density of magnetic convection. The results are similar to those previously obtained for the divining rod. Equations of motion of a perfect fluid are briefly discussed.
Transl. by B.P.

N69-15833*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
INVESTIGATIONS OF DUST IN THE UPPER ATMOSPHERE BY OPTICAL RADAR Final Report, 1 Jul. 1966–31 Jul. 1968
Giorgio Fiocco 30 Nov. 1968 10 p refs
(Grant NGR-22-009-114)
(NASA-CR-99157) Avail: CFSTI CSCL 04A

Final results are reported for a research project involving investigations of dust in the upper atmosphere using optical radar. Papers were published on the following aspects of the project: (1) Production of ionization by micrometeorites; (2) Stratospheric aerosol layer studies during 1964 and 1965; (3) Spectral analysis of laser echoes obtained from atmospheric constituents; (4) Influx of extraterrestrial dust into the earth atmosphere; (5) Anistropy of electron velocity distribution in a reflex discharge; and (6) Electron density and temperature measurements in a reflex discharge by scattering of continuous wave argon laser radiation. Manuscripts are also in preparation on optical radar observations of mesospheric aerosols in Norway during 1966, and the spectrum of coherent light scattered from a turbulent jet. As a result of the project, it was concluded that ground based optical radar observations provide a substantially accurate technique for measuring atmospheric dust content and its dynamics.
A.C.B.

N69-15856*# Michigan Univ., Ann Arbor. School of Natural Resources.
REMOTE SENSING OF CHANGES IN MORPHOLOGY AND PHYSIOLOGY OF TREES UNDER STRESS Annual Progress Report
Charles E. Olson, Jr. and Jennifer M. Ward Berkeley, Calif. Forestry Remote Sensing Lab. 30 Sep. 1968 41 p refs Prepared for Calif. Univ., Berkeley
(NASA Order R-09-038-002)
(NASA-CR-99183; APR-2) Avail: CFSTI CSCL 02F

Greenhouse work with tree seedlings exposed to varying concentrations of NaCl and $CaCl_2$ indicates that the oak species tested are more resistant to salt injury than aspen, tulip popular, maple, or willow; and that salt tolerances of these species decreases in the order listed. No consistent differences in foliar reflectance or moisture tension between salt-treated and control plants are observed until leaf mortality occurred. Drought conditions in sugar maple seedlings, created by varying the frequency of watering, were accompanied by increasing foliar reflectance of the stressed plants at all wavelengths from 0.5 to 2.5 micrometers. Previsual detection of drought or salt-stress was not achieved using color or infrared-color photography in the laboratory. Field tests of infrared scanning systems for detecting moisture stress in mature trees were also begun. Girdled oaks were successfully detected in daytime imagery obtained from altitudes up to 4,000 feet above mean terrain. Detection was unsuccessful from any altitude at night. Author

N69-15870# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENERGY ASPECTS OF RADAR SCANNING OF LIMITED AREAS OF THE EARTH'S SURFACE
B. F. Vysotskiy et al. *In its* Radar Theory and Tech. 29 Dec. 1967 p 1-9 (See N69-15869 05-07)
Avail: CFSTI

Strip-scanning of the earth's surface by a radar mounted on a craft is considered. Calculations are made for two types of scanning, both of which scan narrow, fixed-width strips of the earth's surface from a preassigned altitude. In the first type the earth is scanned in the direction of the flight with a scanned Q. ray; in the second, the earth is scanned sideways with respect to the direction of flight with a fixed ray. In the design of such a radar, it is more convenient to use the relationship of the threshold signal to the absolute magnitude of the echo signal than to use only the absolute magnitude of the echo signal. Calculations indicate that the best results are obtained for strip-scanning at points distant from the craft. The width of the scanned strip is limited by the radar antenna aperture in the vertical plane. The above calculations do not compensate for the earth's curvature or attenuation of the radar signal in the atmosphere. Author

N69-15881# Stevens Inst. of Tech., Hoboken, N. J. Davidson Lab.
A METHOD FOR COMPUTING FLOAT PLATFORM MOTIONS IN WAVES Final Report
John A. Mercier Oct. 1968 62 p refs
(Contract N600(19)-62908)
(AD-678333; fl-1322) Avail: CFSTI CSCL 8/3

A new procedure for predicting the motions in waves of ocean platforms supported by slender vertical floats is presented. The equations of motion for harmonic oscillation in heave, surge and pitch are solved using experimental information describing the hydrodynamic forces acting on the floats. These hydrodynamic forces are obtained from tests conducted on a single isolated float and are expressed as two separable parts: one due to the disturbance imposed by the waves acting as though the vehicle were completely restrained, and one due to the motion of the vehicle as though there were no disturbance. Comparison of the measured motions of a free four-float vehicle with motions computed according to the new procedure reveal good agreement. This approach should be useful for design development and for structural load evaluation for multi-float vehicles as well as for other types of marine structures. Author (TAB)

N69-15884# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
UPPER MANTLE INHOMOGENEITY IN THE WESTERN PART OF CENTRAL ASIA [O NEODNORODNOSTI STROENIYA VERKHNEI MANTII NA ZAPADE SREDNEI AZII]
V. I. Shraybman Sep. 1968 14 p refs Transl. into ENGLISH from Sov. Geol. (Moscow), v. 10, no. 8, 1967 p 101-106
(AD-678354; ACIC-TC-1476) Avail: CFSTI CSCL 8/7

The translation is a study of the problem of heterogeneity in the structure of the upper mantle. At present, gravimetric data are one of the basic sources of information concerning the structure of the upper mantle. However, gravimetry itself can solve only limited problems. It is possible to eliminate the gravity effect of basic heterogeneities of the earths crust from the Bouguer anomalies. This can be done by securing data on the crustal structure by the method of deep seismic sounding then calculating the gravity effect of boundary surfaces of the earths crust. This is in conjunction with the gravimetric information. The residual gravity anomalies will be much more closely connected with heterogeneities of the upper mantle. Residual gravity anomalies were calculated for the western regions of Central Asia. The analysis of the density characteristic of the crustal section in the Turan plate showed that the basement surface and the M surface are the most active gravity boundaries. The gravity effect of the basement surface relief was calculated by using increasing excessive density in proportion to depth. Author (TAB)

N69-15885# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
EXPERIMENT IN MARKING CONTROL POINTS IN A FOREST [OPYT MARKIROVKI OPOZNAKOV V LESU]
G. N. Timushev Sep. 1968 9 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 11, 1966 p58-59
(AD-678361; ACIC-TC-1463) Avail: CFSTI CSCL 8/2

In stereotopographic surveying of wooded areas at large scales, a requirement arises in marking. This requirement not only concerns the large number of horizontal and vertical control points, but also some auxiliary points which are necessary for a more accurate calculation of the height of the forest in the sketching of contour lines and for plotting on aerophotographs, reference points which are hidden under cover of the forest. An experiment was conducted, having as its reason a search for a more rational method of marking control points in a forest for large-scale mapping. Marking signs were painted with white oil paint and silver-like aluminum paint. One half year later, a check up was made. A stereoscopic examination was used to attain positive identification. Having stereophotogrammetric instruments with magnification on the optical system 2-6x, it is possible for large-scale surveys of forest massifs in populated regions to use as marking signs in the trees, posts which have white and silver-colored identification signs. At the scale of the aerophotograph, the size of a side of one of these signs is 0.05-0.1 mm for auxiliary points and 0.1-0.2 mm for horizontal and vertical control points. Author (TAB)

N69-15887# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
THE TYPES OF MAIN LINEAR TECTONIC STRUCTURES OF THE EARTH [TIPY GLAVNYKH LINEINYKH TEXTONICHESKIKH STRUKTUR ZEMLI]
G. D. Azhgirei Sep. 1968 11 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Ser. Geol. (Moscow), v. 177, no. 3, 1967 p 651-654
(AD-678359; ACIC-TC-1432) Avail: CFSTI CSCL 8/7

In the upper parts of the earths crust there are two main complexes of structures: linearly expanding concentration belts of rock deformations, usually discontinuous and in some cases folding, depressions and uplifts of different nature and dimensions, isometric or slightly stretched. Linear structures are investigated in this paper. Some of them are called mobile belts and some are called fracture zones because a deformation which develops in them basically occurs in extensive regional fractures and does not always encompass wide belts of the terrestrial crust. It is suggested that the regional linear tectonic structures of the earth be divided into a least four main types comparable in terms of dimensions and significance. It has been determined that the isolated types of linear structures have roots in the earths mantle which is the basis for the study of the earths mantle by geological methods. It is not improbable that there still exists one or two genetically isolated types of main linear tectonic structures of the earth. Investigations connected with their isolation continue. Author (TAB)

N69-15889# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

ON THE SOLUTION OF STOKES' PROBLEM FOR AN EQUIPOTENTIAL SURFACE GIVEN IN THE FORM OF A SPHEROID [K RESHENIYU PROBLEMY STOKSA DLYA UROVENNOI POVERKHNOSTI ZADANNOI V FORME SFEROIDA]

V. D. Andreev Oct. 1968 12 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 30, no. 2, 1966 p 410–413 (AD-678356; ACIC-TC-1418) Avail: CFSTI CSCL 8/5

Expressions in the form of special, rapidly converging series are obtained for the projection of the intensity of the regularized earths gravity field on its surface and on the outside. TAB

N69-15910# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

EXPERIENCE OF ORGANIZATION AND METHODS OF TOPOGRAPHIC INTERPRETATION IN MOUNTAIN REGIONS [OPYT ORGANIZATSII I METODIKI TOPOGRAFICHESKOGO DESHIFRIROVANIYA V GORNYKH RAYONAKH]

N. A. Stupin Sep. 1968 9 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 1, 1966 p 43–46 (AD-678362; ACIC-TC-1458) Avail: CFSTI CSCL 8/5

The paper is a study of the procedure used to interpret the topography in mountain regions. Topographic maps at 1/25000, 1/100,000 and 1/300,000 scales and photogrammetric materials are obtained from the cartographic plant. Reference material, directories, bulletins, road maps, etc., are also sent. Special courses are set up for less experienced topographers. Preliminary office interpretation is begun with outlining the useful areas on the aerophotographs and plotting the trapezoid frames. Aerial photographs are examined and marked. On the average of from 25 to 30 linear km of route field classification is projected for one trapezoid. The projected routes are transferred onto a reproduction of the preliminary compilation. Airplanes and helicopters are used where survey areas are difficult to reach. The results of the preliminary office interpretation are supplemented and improved with the aid of the field classifications. Author (TAB)

N69-15912# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

NEW DOCUMENTS FOR PLANNING, DESIGNING, AND FINANCING OF TOPOGRAPHIC-GEODETIC WORK [NOVYE DOKUMENTY DLYA PLANIROVANIYA PROEKTIROVANIYA, I FINANSI ROVANIYA TOPOGRAFO-GEODEZICHESKIKH RABOT]

V. V. Kishinskiy et al Oct. 1968 15 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 12, 1966 p 3–10 (AD-678363; ACIC-TC-1451) Avail: CFSTI CSCL 8/7

By order of the Ministry of Geology, USSR, issued on 1 Jan 1967, new instructions were put into effect regarding the planning, designing and financing of topographic-geodetic work. Author (TAB)

N69-15953# Joint Publications Research Service, Washington, D. C.

TEN YEAR PROGRAM FOR WORLD OCEAN STUDIES

L. A. Zenkevich et al 16 Dec. 1968 35 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 8, no. 5, Sep.–Oct. 1968 p 779–800 (JPRS-47090) Avail: CFSTI

The scientific basis of a ten year program for the investigation of the world ocean is described. The importance of the ocean as a regulatory mechanism for many processes of global significance is emphasized, such as the effects of outstanding temperature changes and the exchange of carbon dioxide and oxygen. It is recommended that the following subject areas be included in the long range research plan: 1) Interaction of the ocean and atmosphere, including the influences exerted on the hydrosphere from outer space; 2) Physical structure of the ocean in relation to water circulation, vertical structure and mean water level; 3) Oceanic chemistry, including physical chemistry, equation of state for sea water, chemical balance, chemical water exchange, and organic substances; 4) Bio-oceanographic problems centered around study of the global character of life in the ocean and utilization of its organic raw materials; and 5) Marine geologic investigations of the processes of sedimentation, geological structure, and history of the ocean. A.C.R.

N69-15984# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany).

KLEINHEUBACHER REPORTS, VOLUME 11 [KLEINEUBACHER BERICHTE, BAND NR. 11]

1968 320 p In GERMAN and ENGLISH Proc. of the Joint Meeting of the Ionospheric Working Group of the Ger. Natl. IRSU Comm. and the Comm. for Wave Propagation of the NTG, KLEINHEUBACH, West Ger., 1965 Avail: CFSTI

Symposium papers on geophysical research, on ionospheric behavior and parameter variations, VLF to UHF wave propagation through ionosphere, meteorological phenomena and ground wave propagation are presented. For individual titles see N69-15985 through N69-16037. ESRO

N69-15985# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany).

THE TEMPERATURE OF THE EXOSPHERE AND THE IONOSPHERE [DIE TEMPERATUR DER EXOSPHAERE UND DIE IONOSPHAERE]

W. Becker *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 13–16 (See N69-15984 05-13) refs In GERMAN Avail: CFSTI

The relationship between the exosphere and ionosphere and the seasonal anomolies of the variation in height of the F-layer at noon are considered. It is shown that these correspond exactly in phase to the temperature anomaly of the exosphere and that they are both correlated with solar activity. ESRO

N69-15986# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut für Ionosphärenphysik.

NIGHT TIME ELEVATION OF THE IONOSPHERE, SYNOPSIS AND INTERPRETATION [DER NAICHTLICHE ANSTIEG DER IONOSPHAERE, SEINE SYNOPSIS UND DEUTUNG]

Eugen Eisemann *In* Fernmeldtech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 17–21 (See N69-15984 05-13) refs In GERMAN Avail: CFSTI

The night-time elevation of the F-region over Lindau/Harz (West Germany) is analyzed and correlated with similar data from other stations. It is shown that electromagnetic processes can account for the early morning decrease of the F-layer height and a model ionosphere, consisting solely of ions and neutral particles is proposed. ESRO

N69-15987# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut für Ionosphärenphysik.
THEORETICAL DESCRIPTION OF THE BEHAVIOR OF THE NIGHT TIME F-REGION [THEORETISCHE BESCHREIBUNG DES VERHALTENS DER NACHTLICHEN F-SCHICHT]
Peter Stubbe *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 23-29 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

The elevation of the F-layer in the first half of the night and the rapid decrease of the electron density during the same period are discussed. Solving the continuity equation without neglecting internal friction leads to an atmospheric model which is compared with several current hypotheses. It is shown that electron losses, diffusion, and the horizontal components of the electric field must all be taken into consideration. ESRO

N69-15988# Ionospharen-Institut Breisach (West Germany).
HORIZONTAL PLASMA DRIFT INFERRED FROM IONIZATION CHARTS [HORIZONTALE PLASMAVERSCHIEBUNGEN AUS IONISATIONSKARTEN ERSCHLOSSEN]
K. Rawer and H. Thimm *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 31-35 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Ionization charts for the period July 1957 – December 1958 were used to study movements of the ionized plasma both in latitude and time. Monthly mean values of the maximum F-layer plasma frequency were plotted but it is still not clear whether the variations are due to actual plasma movements or to new ionization. ESRO

N69-15989# Tubingen Univ. (West Germany). Inst. for Theoretical Physics.
THE SOLAR X-RAY SPECTRUM ACCORDING TO OBSERVATION AND THEORY [DIE ROENTGENSTRAHLUNG DER SONNE NACH BEOBACHTUNG UND THEORIE]
G. Elwert *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 37-42 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

High resolution X-ray spectrum density measurements of the solar corona are compared with values computed for a corona temperature of 10^6°K. A new coronal ionization formula and the dielectronic recombination are introduced leading to a better correlation with the observed values. ESRO

N69-15990# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut fuer Ionosphaerenphysik.
THE ANNUAL SEASON ANOMALY OF THE IONOSPHERE AND ITS DEPENDENCY ON SUNSPOT CYCLES [DIE JAHRESZEITLICHE ANOMALIE DER IONOSPHAERE UND IHRE ABHAENGIGKEIT VOM SONNENFLECKENZYKLUS]
W. Becker *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 45-46 refs In GERMAN (See N69-15984 05-13)
Avail: CFSTI

The seasonal anomaly of the ionospheric F region can be observed during sun spot cycles by daily minimal frequency variations at high noon. During years of minimal solar activity, maximal frequency values are measured at equinoxes. Comparison of electron densities in vertical columns with the maximal height of the F layer eliminates the anomaly at sun spot minimum; maximal values are mostly observed during equinoxes. Transl. by G.G.

N69-15991# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany). Forschungsinstitut.
INFLUENCE OF THE GEOMAGNETIC FIELD ON DIURNAL VARIATIONS OF F_0F2 (FOURIER ANALYSIS) [EINFLUSS DES ERDMAGNETFELDS AUF DEN TAGESGANG VON F_0F2 (FOURIER ZERLEGUNG)]
R. Eyfrig *In its* Kleinheubacher Rept., Vol. 11 1966 p 47-54 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Gallet's model of the diurnal and geographical variations of ionospheric data, derived by numerical methods, is discussed. This model however leads to large residuals in the equatorial zone and so a new approach based on magnetic parameters is presented. The physical significance of the first harmonic coefficient of the Fourier analysis is discussed. ESRO

N69-15992# Heinrich-Herz-Institut, Berlin (West Germany).
INVESTIGATION OF NONHOMOGENEOUS STRUCTURE OF THE F REGION BY STATISTICAL ANALYSIS OF FIELD STRENGTH VARIATIONS [UNTERSUCHUNG DER INHOMOGENEN STRUKTUR DER F-SCHICHT MITTELS STATISTISCHER ANALYSE VON FELDSTAERKESCHWANKUNGEN]
K. Bischoff *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 55-59 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Routine field strength recordings at 3.86 MHz show that the ratio of normal to scattered reflected energy is significantly correlated with daylight and seasons. It is assumed that this correlation is partly due to variations of the cross-section of the electron density irregularities. The determination of the random displacements ignoring the horizontal drift is of little value but agreement between the theoretical and experimental values of the self correlation function can be obtained using an index of refraction ≈0.1. ESRO

N69-15993# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut für Ionosphärenphysik.
ORDER OF MAGNITUDE OF IONIZATION VARIATIONS IN THE F2-LAYER AT EQUATORIAL LATITUDES [GROESSENORDNUNG VERSCHIEDENER IONISATIONSSCHWANKUNGEN IN DER F2-SCHICHT AEQUATORIALER BREITEN]
G. Lange-Hesse *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 61-66 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Periodic variations of the F2-ionization in equatorial latitudes are analyzed. The effects of lunar tides are estimated and shown to be important. The influence of wave and particle scattering is discussed and both are shown to be negligible except at sunspot maximum when wave scattering can no longer be neglected. ESRO

N69-15994# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut für Ionosphärenphysik.
TRANSMISSION COEFFICIENT M(3000)F2 AND ITS DEPENDENCE ON SEVERAL IONOSPHERIC PARAMETERS [DER UEBERTRAGUNGSFAKTOR M(3000)F2 UND SEINE ABHAENGIGKEIT VON DEN VERSCHIEDENEN IONOSPHAERISCHEN PARAMETERN]

W. Becker *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 67–70 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI The dependence of the transmission coefficient on parabolic ionospheric layer parameters, i.e. thickness, height and cut-off frequency is investigated. It is shown that the transmission coefficient is a function of altitude modification and thickness variation but does not vary with cut-off frequency. ESRO

N69-15995# Ionosphären-Institut Breisach (West Germany).
COMPARISON BETWEEN DRIFT MEASUREMENTS MADE IN FREIBURG AND PUERTO RICO [VERGLEICH DER DRIFTMESSUNGEN VON FREIBURG UND PUERTO RICO]
E. Harnischmacher *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 71–78 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

The E-drift components over Freiburg and over Puerto Rico are quantitatively compared. It is shown that the prevailing components (Pc) at both places are well correlated and likewise for the 12-hour period (12 HP) and 24-hour period (24 HP) components. ESRO

N69-15996# Leipzig Univ. (East Germany). Geophysical Observatory.
COMPARISON OF IONOSPHERIC DRIFT MEASUREMENTS WITHIN THE LONG WAVE BAND AT TWO STATIONS 300 km APART [VERGLEICH VON IONOSPHAERENDRIFTMESSUNGEN IM LANGWELLENBEREICH AN ZWEI 300 km VONEINANDER ENTFERNTEN STATIONEN]
K. Sprenger (Observatorium fuer Ionosphaerenforsch) and R. Schminder *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 79–87 refs In GERMAN; ENGLISH summary (See N69-15984 05-13)
Avail: CFSTI

Closely spaced receiver drift measurements in the lower ionosphere, using low frequency radio transmitters at oblique incidence, are being made continuously almost every night since several years at two stations in the German Democratic Republic, separated by a distance of about 300 km. After formerly having successfully compared the mean drift results of these observations with the well known radar meteor drift results of Jodrell Bank now a comparison is made between individual simultaneous drift measurements of the two stations in a synoptical way. It can be shown that in 75 percent of the nights the results of the two stations are nearly identical, including also synchronous rotations or sudden reversals of the observed drift vector. This may be taken as an excellent confirmation of the significance of such observations. However, there are another 20 percent of nights with also systematic rotations or reversals but with phase differences of several hours at the different observing sites. Perhaps an explanation of these phenomena may be tried by assumption of occasional strong vertical drift gradients in connection with slight variations of the reflection height. Seasonal anomalies of drift directions during spring and autumn, consisting of a temporary reversal of the prevailing drift towards W and a simultaneous phase anomaly of the semi-diurnal component, have been observed every year by nearly the same times as both stations. There was also another anomaly of drift direction in 1963, January, which possibly may be in connection with the strong stratospheric warming event of that winter. A slight sunspot cycle dependence of drift velocity and drift direction seems to be discernible from the observations of one of the stations. Author

N69-15997# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut für Ionosphärenphysik.
RESONANCE PHENOMENA IN THE UPPER IONOSPHERE
C. B. Goe *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 91–97 (See N69-15984 05-13) refs.
Avail: CFSTI

Topside resonance phenomena have been recorded using both sweep and fixed frequency sounders. The more conspicuous exit splashes occurring on the fixed frequency rocket records were associated with the magnetoionic reflection conditions. It was concluded that irregularities in the electron density were responsible for the multiple reflections occurring at $X=1+Y$ and $X=1-Y$. The Alouette spikes (sweep frequency) were shown to occur at $f_N(X=1)$, $f_M(X=1-Y^2)$, $2f_M$ and the harmonics of the electron gyrofrequency ($Y=1/n$). The resonance occurring at f_N was interpreted as an electrostatic oscillation along the magnetic field lines; the resonance at f_M was interpreted as a transverse oscillation representing the joint influence of electrostatic and magnetic forms on the electrons. ESRO

N69-15998# Max-Planck-Institut fur Physik und Astrophysik, Munich (West Germany).
ARTIFICIAL ION CLOUDS IN THE UPPER ATMOSPHERE [KUENSTLICHE IONENWOLKEN IN DER HOCHATMOSPHAERE]
Bernhard Meyer *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 99–102 (See N69-15984 05-13) In GERMAN
Avail: CFSTI

The behavior of ionized clouds in a magnetic field has been studied with barium and strontium vapor clouds released from rockets. The clouds moved transverse to the magnetic field with a velocity of 35 ms1 and this phenomenon is explained in terms of an electric field. Ion densities were also measured and the efficiency of the method in interplanetary space is discussed. ESRO

N69-16000# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. für Ionosphärenphysik.
INFLUENCE OF ANTENNAS ON MEASUREMENT OF FARADAY EFFECT IN THE IONOSPHERE [EINFLUSS VERSCHIEDENER ANTENNEN AUF DIE MESSUNG DES FARADAY-EFFEKTES DER IONOSPHAERE]
G. Hartmann *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 107–110 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

In order to employ the Faraday effect it is necessary to know the amplitude maxima and minima accurately and these in turn depend on the accuracy of the measurement of the rotation of the plane of polarization by an antenna. Consequently the effect of the complex refractive index of the earth ground, the effect on the change of azimuth during the passage of the satellite and the effect of nearby antennas are discussed. In some azimuth ranges of the incident ray and of the angle of the incident ray with the normal, it is possible to measure the Faraday effect without any corrections. For other values there is an error, the order of magnitude of which must be evaluated. ESRO

N69-16001# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. für Ionosphärenphysik.
COMPARISON OF DIFFERENTLY CALCULATED VALUES OF THE MAGNETIC COEFFICIENT AND THE EVALUATION OF THE DIFFERENTIAL FARADAY EFFECT [VERGLEICH VERSCHIEDEN BERECHNETER M-WERTE UND DIE AUSWERTUNG DES DIFFERENZ-FARADAY-EFFEKTES]
Jürgen-Peter Schödel *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 113–115 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

The calculation of electron density in the ionosphere from the Faraday effect relies on exact values of the magnetic coefficient and differential rotation of the plane of polarization of a wave transmitted from a satellite. Known values of magnetic coefficient and differential rotation are discussed and a mathematical model is proposed. ESRO

N69-16002# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. für Ionosphärenphysik.
DETERMINATION OF THE ELECTRON CONTENT BETWEEN EARTH SURFACE AND AN ARTIFICIAL SATELLITE BY MEANS OF DOPPLER SHIFT [BESTIMMUNG DES ELEKTRONENINHALTES ZWISCHEN DER ERDOBERFLAECHE UND EINEM KUENSTLICHEN ERDSATELLITEN MIT HILFE DES DOPPLEREFFEKTES]
G. Schmidt *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 117–121 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Signals received from satellites orbiting higher than the ionosphere are frequency moderated by the Doppler effect and the ionosphere properties differing from those of the vacuum. The latter part depends on the emitted frequency and it is possible to identify it using two signals emitted by the satellite on harmonic frequencies. The measurement arrangement is described and results are shown. ESRO

N69-16003# Ionospharen-Institut Breisach (West Germany).
OBSERVATION OF EXPLORER 22 SATELLITE BY MEANS OF DIFFERENTIAL DOPPLER EFFECT [BEOBACHTUNGEN MIT HILFE DES DIFFERENTIELLEN DOPPLER-EFFEKTS AM EXPLORER 22]
H. A. Hess *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 123–126 (See N69-15984 05-13) In GERMAN
Avail: CFSTI

The recording of differential Doppler effect of Explorer 22 started at Breisach (Germany) in 1964. Curves are used to compute the closest approach time by means of inversion of the curve. The electron content is also computed by comparison with a beat frequency. The inversion points are discussed in respect to the flight path of the satellite. ESRO

N69-16004# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany).
PHYSICAL SIGNIFICATION OF THE EQUIVALENT LAYER THICKNESS OF THE IONOSPHERE [DIE PHYSIKALISCHE BEDEUTUNG DER AEQUIVALENTEN SCHICHTDICKE DER IONOSPHAERE]
W. Becker *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 127–133 (See N69-15984 05-13) refs In German
Avail: CFSTI

It is shown why the equivalent layer thickness of the ionosphere exhibits a good correlation with solar activity. It has been deduced that the ratio of integrated electron density above and below the F-layer maximum remains constant during daytime. This ratio has been experimentally determined as being in a first approximation 3:1. In second approximation it is found that the value of this ratio during summer months should be reduced by 20%. It is also shown that a 'mean' electron density profile in the ionosphere should be calculated as this remains valid over the maximum of the F-layer and could help to complete incomplete satellite ionograms. ESRO

N69-16005# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany). Institut fuer Geophysik und Meteorologie.
LONGITUDINAL DEPENDENCE OF THE EQUATORIAL ELECTROJET [LAENGENABHAENGIGKEIT DES AEQUATORIALEN ELEKTROJET]
Jürgen Untiedt *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 135–140 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

The problem of the daily range variations caused by the equatorial electrojet around the magnetic equator and variation in field strength by longitude are discussed. ESRO

N69-16006# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Inst. für Ionosphärenphysik.
RAY-TRACING COMPUTER PROGRAM UNDER CONSIDERATION OF THE GEOMAGNETIC FIELD AND ANY CHOSEN IONOSPHERE MODELS [RAY-TRACING-RECHENPROGRAMM MIT BERUECKSICHTIGUNG DES ERDMAGNETFELDES UND BELIEBIG WAEHLBAREN IONOSPHAERENMODELLEN]
H. Kopka and H. G. Möller *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 141–146 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

The differential equation system which gives the progagation route of electro magnetic waves in a medium with refractive index is transformed into a system of equations which can be solved by computer. The influence of the geomagnetic field, of the variation of the lower limit of the ionosphere layer and of the critical frequency are discussed. ESRO

N69-16009# Czechoslovak Academy of Sciences, Prague. Astronomical Inst.
SPIRAL MOVEMENT ALONG MAGNETIC LINES IN SPREAD OUT GRAVITATIONAL FIELDS [SPIRALBEWEGUNG ENTLANG MAGNETLINIEN IN AUSGEDEHNTEN GRAVITATIONSFELDERN]
E. Chvojkova *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 155–156 refs In GERMAN (See N69-15984 05-13)
Avail: CFSTI

An expanded gravitational field model is used to analyze reflection heights of charged particles moving along magnetic field lines in spiral orbits so that the particles never reach lower atmospheres or outer space. This phenomenon is used to explain electron density channels in the magnetosphere and other ionospheric density variations. Transl. by G.G.

N69-16010# Observatorium für Ionosphärenforschung, Küehlungsborn (East Germany).
RESULTS OF RADAR METEOR OBSERVATIONS OF THE QUADRANTID METEOR SHOWER [ERGEBNISSE VON RADARMETEORBEOBACHTUNGEN DES QUADRANTIDENSTROMES]
P. Glöde *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 157–163 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Meteor Radar observations of the quadrantides showed variations in meteor rates which can be explained by the dependence of the meteor rate on the zenithal distance of the shower radiant and of the shower density at the momentary position of the earth. From the distribution of meteor echo durations the distribution of masses was calculated. Although the quadrantid showers contain relatively many large meteors, the total mass of the sporadic meteors by far outweighs that of the shower so that special geophysical effects of the shower should not be expected. ESRO

N69-16014# Centre National de la Recherche Scientific, Meudon (France). Laboratoire de Physique Cosmique.
ON THE DIURNAL VARIATION OF THE MEAN ENERGY OF X-RAY FLARES IN THE POLAR AURORAL ZONE [UEBER DEN TAGESGANG DER MITTLEREN ENERGIE VON ROENTGENSTRAHLUNGS-AUSBRUECHEN IN DER POLARLICHTZONE]
A. Bewersdorff, J. Dion, J. P. Legrand, G. Kremser (Max-Planck-Inst. für Aeronomie), E. Keppler (Max-Planck-Inst. für Aeronomie) et al *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 185–190 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Balloon measurements of the electron X-ray bremsstrahlung up to heights of 30 - 35 km have shown that the average energy of X-ray flares in the energy range between 20 and 150 km follows a daily variation. The spectrum is steepest shortly after midnight and then flattens out until the afternoon. From these measurements it was concluded that this diurnal variation cannot be due exclusively to migrations of the source of radiation, but depends also on variations in the energy spectrum of the primary electrons. ESRO

N69-16015# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut fuer Ionosphaerenphysik.
THE ABSORPTION OF MEDIUM TO HIGH FREQUENCY WAVES IN THE IONOSPHERE [ZUR ABSORPTION VON GRENZWELLEN IN DER IONOSPHAERE]
H. Schwentek *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 191–195 refs In GERMAN (See N69-15984 05-13)
Avail: CFSTI

Statistical evaluation of daily ionospheric absorption measurements at 2.61 MHz showed that the electron density below 75 km height determined daily absorption values. The atmosphere above 30 km height was colder during high absorption days than during periods of low ionospheric absorption. Transl. by G.G.

N69-16016# Ionospharen-Institut Breisach (West Germany).
ELECTRON DENSITY MEASUREMENTS BY MEANS OF IMPEDANCE PROBE ON SARDINIA [ELEKTRONENDICHTE-MESSUNGEN MIT EINER IMPEDANZSONDE UBER SARDINIEM]
K. G. Jacobs *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 197–203 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

By means of an ESRO-fired Skylark rocket electron density profiles were measured by radio spectrometer, impedance probe and Langmuir probe methods to investigate minor fluctuations not discernible in the ionogram. The resulting electron density profile calculated for the resonance frequencies shows a normal course (maximum for the E-layer) in descent only; ascent measurements have obviously been disturbed. ESRO

N69-16017# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). [Institut fuer Ionosphaerenphysik.]
ABSORPTION MEASUREMENTS IN TSUMEB [ABSORPTIONSMESSUNGEN IN TSUMEB]
G. Umlauft *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 205–208 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

By means of pulse echo measurements for vertical incidence it has been shown that during the sunspot minimum the seasonal absorption curve for the E-and the first F-layer does not correspond to theoretical expectation as has been the case for sunspot maximum. This fact may be due to the winter anomaly suppressing the normal seasonal course of absorption. ESRO

N69-16018# Zentralanstalt fuer Meteorologie und Geodynamik, Vienna (Austria).
OBSERVATION OF LONG WAVE DAMPING [EINIGES ZUR LANGWELLENDAEMPFUNG]
Julius Drimmel *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 209–210 ref In GERMAN (See N69-15984 05-13)
Avail: CFSTI

A correlation is established between long frequency wave damping in the D region during day light and atmospheric temperature near the earth surface. Damping preceded temperature variations sometimes by days during the winter season. Transl. by G.G.

N69-16019# Observatorium fuer Ionosphärenforschung, Kühlungsborn (East Germany).
DIURNAL AND ANNUAL VARIATION OF IONOSPHERIC ABSORPTION IN THE LOW FREQUENCY AND RADIO FREQUENCY RANGE [TAGES- UND JAHRESGANG DER IONOSPHAERISCHEN ABSORPTION IM LANG- UND MITTELWELLENBEREICH]
E. A. Lauter and K. Sprenger *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 211–218 (See N69-15984 05-13) refs In GERMAN; ENGLISH summary
Avail: CFSTI

A3-absorption measurements on low and medium frequencies were used to demonstrate diurnal, annual and sunspot cycle variations in the plasma of the lower ionosphere. At negative sun heights absorption is caused in the lowest D-region by photodetachment ionization in the presence of invading high energy particles. After correcting for this, diurnal and annual variations can be described by a cosine law. The winter anomaly of high absorption is strongly decreasing from medium to low frequencies and also with height from 90 to 80 km. A clear anomaly of high absorption occurs in summer, increasing with decreasing frequency, varying in intensity with the sunspot cycle and indicating the control of aeronomical processes in the lower D-region by solar activity and internal changes in atmospheric structure. ESRO

N69-16020# Bonn Univ. (West Germany). Stockert Radio Observatory.
ON THE THEORY OF SEA [ZUR THEORIE DES SEA]
H. Volland *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 219–224 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

From theoretical calculations to determine the number of atmospheric discharges during solar eruptions as depending on the atmospheric frequency, taking into account the discharge density function, the propagation function valid between earth and ionosphere and the frequency dependent average of the radiation component of the spectral field strength, it appeared that the frequency dependence is strongly connected with the threshold value of the receiver and the discharge density function. ESRO

N69-16024# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut fuer Ionosphaerenphysik
DISTURBANCES OF TRANSPOLAR VLF PROPAGATION AND THEIR RELATIONSHIP WITH OTHER GEOPHYSICAL PHENOMENA [STOERUNGEN TRANSPOLARER VLF-AUSBREITUNG UND IHR ZUSAMMENHANG MIT ANDEREN GEOPHYSIKALISCHEN PHAENOMENEN]
K. Rinnert *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 243–248 (See N69-15984 05-13) refs In GERMAN
Avail: CFSTI

Phase disturbances occurring in VLF wave propagation at 16.8 Kc/s through the auroral zone are shown to depend on the change from winter (=night) to summer (=day) conditions in the polar zone related to the UV-caused electron production in the lowest polar ionosphere. Sun flares (electromagnetic radiation and particle influx) or solar plasma cause disturbances of the higher night reflection levels more frequently than disturbances of the lower day reflection levels. ESRO

N69-16025# Max-Planck-Institut fur Aeronomie, Lindau uber Northeim (West Germany). Institut fuer Ionosphaeranphysik.
COMMENTS ABOUT THE SOUTHERN BORDER OF THE WINTER ANOMALY [BEMERKUNGEN ZUR SUEDGRENZE DER WINTERANOMALIE]
G. Rose and H. U. Widdel *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 249-251 In GERMAN (See N69-15984 05-13)
Avail: CFSTI

Geographic field effects on ionospheric D region absorption of radio signals were evaluated for seasonal and daily variations. Results found winter noon day absorption maximal intensities in January and February. This seasonal anomaly showed up much later and ended earlier in southern than in northern latitudes. Daily measurement variations corresponded to electron densities in the D region. Trans. by G.G.

N69-16030# Tubingen Univ., (West Germany). Astronomical Inst.
RAPID VARIATION OF FIELD INTENSITY OVER SHOWER AND THUNDER CLOUDS [SCHNELLE FELDSTAER-KESCHWANKUNGEN UEBER SCHAUER- UND GEWITTER-WOLKEN]
R. Muehleisen *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 277-278 refs In GERMAN (See N69-15984 05-13)
Avail: CFSTI

Radiometeorological measurements are used to study the relationship between ultrahigh frequency absorption in the tropopause and electrostatic field variations and wave absorption over water surfaces. Results show that rapid electrostatic field variations over rain clouds and thundershowers effect atmospheric electricity and cause high frequency scattering. Transl. by G.G.

N69-16035# Fernmeldetechnisches Zentralamt, Darmstadt (West Germany). Forschungsinst.
OBLIQUE-ANGLE REFLECTIONS FROM TROPOSPHERIC INHOMOGENEITIES WITH VERTICAL EXCITATION [SCHRAEGWINKELREFLEXIONEN VON TROPOSPHAERISCHEN INHOMOGENITAETEN BEI VERTIKALER ANREGUNG]
J. Grosskopf *In its* Kleinheubacher Rept., Vol. 11 1966 p 303-306 (See N69-15984 05-13) In GERMAN
Avail: CFSTI

Comparison measurements at two points of vertical and oblique-angle reflections of vertical beams sent into the troposphere showed the origin of coherent reflection at both points to be isotropic emitting regions. This gives a hint to the nature of 'angels' occurring on radar screens. ESRO

N69-16053# Centro Nazionale di Fisica dell'Atmosfera e Meteorologia, Rome (Italy).
THE HARMONIC CONSTANTS OF TIDE MEASURED IN THE GENOA HARBOR AND THEIR VARIATIONS [LES CONSTANTES HARMONIQUES DE MAREE DU PORT DE GENES ET LEURS VARIATIONS]
M. Giorgi and C. Stocchino Consiglio Nazl. Delle Ric. Apr. 1966 27 p refs In FRENCH Submitted for publication
(CENFAM-RDP-2) Avail: CFSTI

The Hydrographic Institute of Italian Navy has undertaken a general study on oceanography. The present report deals with the calculation of 'harmonic constants' of tide, measured in the harbor of Genoa; results and data have been taken over a long period of time (18 years) to exclude all the irrelevant effects. Tables of data are also given. ESRO

N69-16071# IIT Research Inst., Chicago, Ill.
SCAVENGING STUDY OF SNOW AND ICE CRYSTALS Final Report, Apr. 1, 1967-Jul. 31, 1968
Sudesh K. Sood and Meryl R. Jackson 12 Sep. 1968 42 p refs
(Contract AT(11-1)-578)
(IITRI-578-P-32-5; IITRI-C6105-5) Avail: CFSTI

The experimental determination of the scavenging efficiency of simulated snow and ice crystals is described. Paper aerodynamic equivalents of snowflakes have been determined and used throughout this research. The scavenged aerosol consisted of spores of *B. subtilis* of 1μ diameter. For plates of a given material, scavenging efficiency has been found to increase inversely with the diameter of the circumscribed circle. Scavenging efficiency of platelets has been found to increase with electrical charge on platelets. It has also been observed that the ratio of the number of particles deposited on the edges to the total number of particles deposited on the plate remains constant, irrespective of the charge on platelet. This ratio, however, does depend on the perimeter to surface area ratio of platelets. Author (NSA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-15023# Blume (John A.) and Associates Research Div., San Francisco, Calif.
DIRECT READING SCALER FOR MEASURING RECORDED WAVE DATA
Oct. 1968 15 p ref
(Contract AT(26-1)-99)
(JAB-99-40) Avail: CFSTI

The magnitude of ground motion and structural motion can be read directly from seismographic records with the Direct-Reading Scaler. The description, design, and operation of the instrument is given. NSA

N69-15077# Israel Atomic Energy Commission, Tel-Aviv.
MINIMUM NUMBER OF OPERATIONS NEEDED TO IDENTIFY AN OBJECT IN AN ARRAY
Y. Milman May 1968 11 p
(IA-1174) Avail: CFSTI

The minimum number of operations for the complete identification of an object in an array under certain conditions is considered. A lower limit for this number is found, and the strategy of approaching that limit is derived. Author (NSA)

N69-15106 Oklahoma State Univ., Stillwater.
A LASER SOURCE INTEGRATING SPHERE FOR THE MEASUREMENT OF DIRECTIONAL HEMISPHERICAL REFLECTANCE AT HIGH TEMPERATURES
Gerhart Josef Kneissl (Ph.D. Thesis) 1967 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-8436

A reflectometer was designed, built, and tested for measuring the spectral, directional, hemispherical reflectance at high temperatures. Emphasis was placed on the capability to measure reflectance values very accurately and with high precision. The reflectometer consisted of a gas laser as a source, an integrating sphere, and a lead sulfide cell as a detector. The samples were heated by the use of a RF-generator. A theoretical analysis was

performed to predict the systematic errors in the measurements. This analysis was checked by an experimental investigation using calibrated mirrors as reflectance standards. The reflectance of samples of thoria, graphite and tungsten was measured at temperatures up to 2150°K. The theoretical error analysis revealed that the reflectometer could measure the reflectance to better than 1%. The experimental investigation showed that the error analysis is capable of predicting the sign as well as the magnitude of the error. Dissert. Abstr.

N69-15121 Stanford Univ., Calif.
EFFECTS OF FILM NONLINEARITIES IN WAVEFRONT RECONSTRUCTION IMAGING
Gordon Raymond Knight (Ph.D. Thesis) 1967 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-6443

A theoretical analysis is presented of the effects of film nonlinearities in wavefront reconstruction imaging of diffuse objects. A generalization of the understanding of the effects of film nonlinearities on the reconstructed image is given for the case of unrestricted object-to-reference light intensity ratios. While a previous analysis has been presented for large object-to-reference intensity ratios, in most cases of real practical interest, the object and reference light intensities at the film plane must be kept at about the same level to obtain maximum brightness in the reconstructed image. The object-induced bias term in the input exposure can then no longer be ignored, and additional nonlinear effects not predicted by previous analyses are then expected. An expression is given for the intensity distribution of the reconstructed image. The analysis predicts the amount of image spreading, the reduction in contrast, and the form and intensity of false images for wavefront reconstruction imaging of diffuse objects. Dissert. Abstr.

N69-15172# Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.
LIQUID METAL FLOW MEASUREMENT (SODIUM). STATE OF THE ART STUDY
G. E. Turner 28 Jun. 1968 74 p refs
(Contract AT(04-3)-700)
(LMEC-Memo-68-9) Avail: CFSTI

Various types of flowmeters are described and their advantages and disadvantages as applied to liquid metal flow measurement are discussed. It is concluded that the permanent-magnet-type flowmeter most closely meets the requirements of the ideal flow measuring device for use in liquid metal systems. Author (NSA)

N69-15178# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Phys.
THIN-CRYSTAL MOSAIC DETECTION FOR IN VIVO MEASUREMENTS
A. Andrasi, I. Feher, and J. Lendvay 1 Oct. 1968 10 p *Its* No. 14
(KFKI-27/1968/) Avail: Issuing Activity

Investigations of a thin crystal mosiac detector of 400 cm^2 sensitive surface, developed for the human in vivo counting of low energy photons, are reported. The characteristic data of the equipment, resolving power, counting efficiency, and background were measured. The counting efficiency of the mosiac detector for activities deposited in the lung was evaluated on computer using a simple mathematical model which was utilized also for the comparison of the mosaic detector efficiency with that of the earlier used low energy photon detectors. The computer results were checked by a measurement on point source. The design of a possible scanning bed and 4π counter equipment containing several mosaic detectors is discussed. A model measurement is described which has been performed, assuming a ring of 6 mosaic detectors, to evaluate the sensitivity and minimum detectable amount for some important isotopes in the case of multidetector equipments. Author (NSA)

N69-15192 Maryland Univ., College Park.
PIEZOELECTRIC TRANSDUCERS FOR MICROWAVE ULTRASONICS
Gary Erwin Evans (Ph.D. Thesis) 1967 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-7019

An analysis for piezoelectric transducers combined with microwave networks is presented and applied to the design of several devices. Experimental results are presented for cadmium sulfide transducers between electrodes at 0.5 to 2.0 Gc/s, and for transducers including acoustic transformers. Delay lines are described with losses as low as 12 dB for 4 microseconds delay, and single transducer losses estimated to be 2 dB. Microwave structures are described which provide between 3% and 30% half power bandwidth without tuning. The voltage standing wave ratios over these bands are typically below 2:1. Dissert. Abstr.

N69-15205*# Arizona Univ., Tucson.
A HIGH-RESOLUTION SOLAR SPECTROMETER FOR AIR-BORNE INFRARED OBSERVATIONS, NUMBER 128
D. P. Cruikshank, F. A. DeWiess, and Gerard P. Kuiper *In its* Commun. of the Lunar and Planetary Lab., Vol. 7, 1968 p 233-238 refs (See N69-15201 05-30)
Avail: CFSTI CSCL 14B

The construction and operation of a 4-meter Czerny-Turner scanning spectrometer in the NASA Convair 990 Jet aircraft are described. The design of the spectrometer and its mounting support permit high resolution in spite of aircraft vibrations. Maximum resolution achieved was about 60,000, close to the theoretical limit of the optics. Author

N69-15215# Argonne Cancer Research Hospital, Chicago, Ill.
EFFECTS OF SCATTERED RADIATION IN SCINTILLATION DETECTOR RESPONSE
R. N. Beck, M. W. Schuh, T. D. Cohen, and N. Lembares 15 Aug. 1968 31 p refs Presented at the IAEA Symp. on Med. Radioisotope Scintigraphy, Salzburg, Austria, 6-15 Aug. 1968
(Contract AT(11-1)-69; Grant PHS-G-FR-00013)
(ACRH-1000-79; CONF-680804-3) Avail: CFSTI

A complete analysis of the response of a collimated scintillation detector to an in vivo distribution of radioactivity must include the responses to both unscattered γ-rays and the continuous spectrum of photons with reduced energy, produced by Compton interactions in the tissue. The amount of scattered radiation entering the detector is a function of the γ-ray energy, the distribution of radioactivity in the tissue, and the tissue attenuation coefficient. The ratio of responses to scattered and unscattered photons, called the scatter fraction, S, is also a function of the energy resolution of the scintillation detector, and the base line setting, E_B, of the pulse height analyzer. To evaluate S as a function of E_B, it is necessary to know the shape of the scatter spectrum within the unscattered photopeak region. Smoothed scatter spectra were computed for four γ-energies in the range of 140 to 511 keV by smoothing the Klein-Nishina equation for the energy spectrum of scattered photons. Author (NSA)

N69-15222# California Univ., Livermore. Lawrence Radiation Lab.
HOT NITROGEN GAS FOR HEATING THERMOLUMINESCENT DOSIMETERS
K. F. Petrock and D. E. Jones 13 Sep. 1968 22 p refs Submitted for publication
(Contract W-7405-eng-48)
(UCRL-71089; CONF-680920-5) Avail: CFSTI

Improvements in TLD reader design, especially the use of hot nitrogen gas for the heating of TLD phosphors, are described. This heating mechanism has been in use for several months in an automatic TLD reader designed at LRL. The reader reads 80 extruded LiF rods over a dynamic range of 3 mR to 1000 R in 40

min or less. The improved electronics gives a digital light sum and can simultaneously give digital glow curves for all except the minumum doses. This reader has proven to be extremely reliable as well as relatively simple in construction. The hot-gas heating technique was found to have some excellent characteristics: it is very efficient, it gives a low thermal glow and there is no heater pan to change in emissivity or reflectivity, and the background thermal glow is nearly constant throughout the reading cycle. Author (NSA)

N69-15327# Technische Hochschule Munchen (West Germany).
A TRACK-PULSED MAGNETIC TAPE RECORDER OF HIGH SIGNAL DENSITY WITH NRZ READING AND RECORDING PROCEDURES [EIN SPUR-TAKTIERTER MAGNETBAND-SPEICHER HOHER ZEICHENDICHTE MIT NRZ-LESE-UND AUFZEICHNUNGSVERFAHREN]
Winfried Hahn (Ph.D. Thesis) 1968 111 p refs In GERMAN
Avail: CFSTI

Elimination of time differentials in shift registers and synchronization of reading signals by linear passive filters is used to increase the bit density on digital magnetic tapes. This combination method produces a maximal signal density independent of interchannel time displacement and peak shifts and allows for the construction of high density magnetic heads with more than 6000 bits/inch. Transl. by G.G.

N69-15328# Royal Aircraft Establishment, Farnborough (England).
PERFORMANCE ANALYSIS OF A LOW-RANGE VIBRATING-CONTACT PRESSURE TRANSDUCER
H. K. P. Neubert Jan. 1968 28 p refs
(RAE-TR-68011/UL) Avail: CFSTI

A mathematical analysis is given, based on energy considerations, of the performance of a vibrating-contact transducer for the measurement of very low static and quasi-static pressures. Although resting on several simplifying assumptions, it provides useful information on the relevant design parameters and brings out the salient features of major transducer characteristics, such as on-off time ratio, sensitivity, range and frequency of oscillation. The theoretical results are shown to be consistent with measurements obtained with an experimental transducer model. Author

N69-15336# Mound Lab., Miamisburg, Ohio.
A STATISTICAL EVALUATION OF A GAS PRESSURE VOLUME TEMPERATURE MEASUREMENT SYSTEM
D. R. Bohl and D. E. Sellers 11 Oct. 1968 18 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1557) Avail: CFSTI

A data evaluation study was conducted to statistically evaluate a gas pressure volume temperature system for measuring the amount of gas evolved from a thermally decomposed sample. The standard deviation and confidence intervals were calculated using historical data from the gas measurement analytical procedure. Conventional statistical formulas were used to evaluate the data. Author (NSA)

N69-15381*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
AN OPTICAL SYSTEM FOR RECORDING SCHLIEREN IMAGES WITH A CONTINUOUS WRITING ULTRA HIGH SPEED FRAMING CAMERA
Lemuel E. Mauldin, III and E. Conrad Compton Washington Jan. 1969 33 p refs
(NASA-TN-D-4986) Avail: CFSTI CSCL 14E

The integrated system comprising the ultrahigh speed camera, the f/8 Z-light-path schlieren system, the focusing lenses, the square-wave-pulse light generator, and the two-beam knife-edge assembly affords up to 72 consecutive schlieren photographs at a recording rate up to 1,200,000 frames per second. The generator provides selectable pulse durations of 60, 250, and 1000 microseconds. This controlled-duration light source eliminates the need for an elaborate high speed shutter normally used with continuous light sources. A two-beam knife-edge assembly splits the Z-type schlieren beam into two separate and complete schlieren images of the test area and direct them into the camera. The system provides good quality pictures of supersonic particles and hypersonic gas flow. Author

N69-15396# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPROVEMENT OF SPECTRAL CHARACTERISTICS OF HIGH-RESISTANCE THERMAL RADIATION DETECTORS
L. S. Kremenchugskiy et al 19 Dec. 1967 9 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR), v. 4, no. 4, 1966 p 298-301
(AD-678468; FTD-HT-23-1354-67) Avail: CFSTI CSCL 17/5

An improved method is proposed for the construction of high-resistance thermal-radiation detectors which use gold-black as the infrared absorber. Because of its poor adhesive properties, gold-black cannot be deposited directly on the sensitive material, but must be deposited on an interleafing layer, which causes high heat losses. Calculations are presented to demonstrate that these losses can be reduced to an insignificant amount if the interleafing layer is made of dielectric such as beryllium- or aluminum-oxides, which are good heat conductors, and if the layers thickness is much less than the length of the incident heat wave. Author (TAB)

N69-15453*# Rochester Univ., N. Y. Inst. of Optics
THE DESIGN AND DESCRIPTION OF A 300–1200 Å STELLAR SPECTROGRAPH
Neil A. Hochgraf and Roman Kucil 1968 75 p
(Contract NASr-14)
(NASA-CR-99059) Avail: CFSTI CSCL 20F

The description and design of a superior single surface concave grating stellar spectrograph is presented for the vacuum ultraviolet region having 1 Å resolution, f/5.5 optical speed and being an experimentally complete self-contained instrument except for a 24 v dc power supply. The optical and mechanical designs are highly developed and residual errors are also cited along with appropriate corrections. This rocket spectrograph design is capable of operating very satisfactorily in different spectral regions, with different grating apertures and radii, different grating film plane-order formats, as well as with vastly different exposure times or multiples of nine stellar exposures. These features are available with minor change while the optical performance can be substantially improved by the built-in grating warping feature. This rugged 24# magnesium flight package has convenient adjustment, dependable alignment and ease of service with attention given to foolproof design so as to give first quality data everytime. Author

N69-15455# California Univ., Berkeley. Lawrence Radiation Lab.
RAPID SPECTROMETER ANALYSIS
Arthur B. Wicklund Jul. 1968 38 p
(Contract W-7405-ENG-48)
(UCRL-18317) Avail: CFSTI

A general solution of Maxwell's equations which describes the field of a spectrometer magnet with precision and accuracy is presented. For example, starting with 70,000 field measurements made on an 18 × 36 × 8-in. bending magnet (AEC 87 522) 200 parameters emerge which describe all components of the field everywhere at all currents with errors less than 4×10^{-4} of the central field values (typically 1 or 2 gauss out of 15,000); measured line integrals are reproduced within one part in 10^4. To summarize the solution: the field is described by cuts and poles near the real axis defined by the longitudinal path through the field. Particle orbits have a corresponding singularity structure. Inhomogeneities in the field are introduced as perturbations on the residue functions which depend on the orbit characteristics; by

means of the residue theorem, one can take these inhomogeneities into account by simply adding up the perturbed residue functions.
Author (NSA)

N69-15458# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
NEUTRON DOSIMETRY WITH ACTIVATION FILTERS AND TLD
L. F. Kocher and G. W. R. Endres 5 Sep. 1968 15 p refs Presented at 2d Intern. Conf. on Luminescence Dosimetry, Gatlinburg, Tenn.
(Contract AT(45-1)-1830)
(BNWL-SA-1831-Rev-1; CONF-680920-3) Avail: CFSTI

A TLD dosimeter technique has been developed to quantitatively determine fast and thermal neutron dosages from mixed radiation exposures. For fast neutron dosimetry, this method takes advantage of the scattering of thermalized neutrons from a hydrogenous moderator. The dosimeter housing consists of a standard Hanford beta-gamma film badge dosimeter. Three filters, consisting of combinations of lead, stainless steel, tin, cadmium, and rhodium are matched so as to produce equal TLD response from photon radiations. The fast and thermal neutron exposure is determined from the TLD response produced by the capture of moderated neutrons in the filter material. Where heterogenous radiation fields are encountered, a portion of the thermal neutrons is absorbed in one of the rhodium filter sandwiches. This differential forms the basis of a system to distinguish between fast and thermal neutrons.
NSA

N69-15484*# GCA Technology Div., GCA Corp., Bedford, Mass.
COLD CATHODE GAUGE DEVELOPMENT. Final Report, 29 Apr. 1965–20 Dec. 1966
Wallace S. Kreisman Dec. 1968 133 p refs
(Contract NAS5-9180)
(NASA-CR-99081; GCA-TR-67-1-N) Avail: CFSTI CSCL 14B

Studies of basic characteristics of magnetron type cold cathode ionization gauges are presented. Specialized equipment was developed and used to determine the distribution of nitrogen and helium positive ion energies and to provide data for the calculation of positive ion origins and trajectories. The trajectory equations were applied to the design of a magnetron gauge mass spectrometer. Gauge pumping and re-emission characteristics for nitrogen were studied. The response of a cold cathode gauge to cycling pressures was determined with the aid of a unique cycling valve and a special test system. Gauge stability, noise and calibration experiments were performed.
Author

N69-15594# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
VARIANT OF A NUCLEAR MAGNETIC FIELD METER
V. F. Belov et al 5 Jan. 1968 9 p refs Transl. into ENGLISH from Tr. Inst. Neftekhim. i Gaz. Prom. (Moscow), no. 58, 1965 p 98–100
(AD-678433; FTD-HT-23-1196-67) Avail: CFSTI CSCL 7/4

A version of the device for exact measurement of magnetic field by the NMR method is briefly described. The device is based on the resonance absorption of r-f energy by water protons. A constant magnetic field produced by the NS magnet of an RE-1301 radiospectroscope is oriented at right angles to the r-f field. The magnetic field is stabilized by an electronic device in the 50-cps circuit. The r-f field is produced by oscillator-detector 3. The oscilletory-circuit coil is wound on a quartz vial containing distilled water and placed in airgap 2. Wavemeter 6 measures the frequency. A grid-leak-detected signal is applied to 1-f (gain 500) amplifier 4. NMR signal is recorded by oscillograph 5. The field strength measuring range is 1000-4000 oe (magnetic semiconductor measurements); total error, 7%.
TAB

N69-15659# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
INSTRUMENT DEVELOPMENT BRANCH Annual Report, 1967
R. G. Morrison ed. Aug. 1968 125 p refs
(Contract AT(10-1)-205)
(IDO-17269) Avail: CFSTI

Transducer development, including eddy current techniques, ultrasonic techniques, acoustic emission, neutron and reactor fuel temperature measuring techniques, flow detection, and a capacitance sensing height gage for nonconductive liquids, is reported. Systems engineering development, including computer interfaces, control systems, and specialized components, is described. Instrumentation for the ex-reactor ATR in-pile tube vibration simulation apparatus, seismic switch calibration system, vibration instrumentation during the ATR startup, and Zircaloy-2, zirconium oxide emissivity are discussed.
NSA

N69-15671# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ATOMIC TIME
N. S. Blinov. 19 Dec. 1967 15 p refs Transl. into ENGLISH from Zemlya i Vselennaya (USSR), no. 5, 1966 p 43–47
(AD-678436; FTD-HT-23-1366-67) Avail: CFSTI CSCL 14/2

The report describes quartz clocks, ammonium and cesium frequency standards and other modern means for precise time determination. For example, it is noted that the use of cesium standards in combination with a quartz clock has made it possible to create a basically new time standard independent of the earths rotation. The resulting time scale is known as atomic time. The abbreviation is TA-1; its uniformity is considerably greater than that obtained from astronomical observations. The introduction of atomic standards in the time service has considerably changed their problems. The availability of these new time standards is making possible more precise study of changes in the earths rate of rotation and is yielding new information on the internal structure of the earth.
Author (TAB)

N69-15750*# IIT Research Inst., Chicago, Ill. Technology Center.
A FAST NEUTRON SPECTROMETER OF ADVANCED DESIGN Final Report, 1 May 1966–30 June 1967
W. E. Zagotta and R. B. Moler 30 Jun. 1967 68 p refs
(Contract NAS8-11885)
(NASA-CR-98236; IITRI-V6020-28) Avail: CFSTI CSCL 20F

This report describes the development and initial testing of a He^3 sandwich-type neutron spectrometer. A unique feature is that the He^3 gas is used as the filling gas of two identical proportional counters which permits effective discrimination against background gamma radiation, discrimination against interfering reactions in the silicon detectors, and an improvement in resolution, especially at low neutron energies. The preprototype system exhibited a 5.4 8-MeV alpha resolution of from 150 to 250 ceV, FWHM, and a thermal pea k resolution of 200 keV. It was found that, in the absence of a neutron source, no accidental gamma events could be observed up to gamma dose rates of 10^5 r/hr. A modification of the system to one using thinner solid-state detectors and a neutron converter material of Li^6 is suggested. It is expected that the modified system will perform in gamma backgrounds as high as 10^4 r/hr with a resolution of about 0.5 MeV.
Author

N69-15761# United Kindgom Atomic Energy Authority, Harwell (England). Information Branch.
STABILIZATION SYSTEM FOR A TIME-OF-FLIGHT SPECTROMETER OF NANOSECOND RANGE
V. G. Lapshin Sep. 1967 25 p refs Transl. into ENGLISH from JINR Rept. JINR-P13-3342, 1967
(NP-tr-1693) Avail: CFSTI

A stabilization system is described of a time-of-flight nanosecond range spectrometer using two reference time intervals

between the womps from the semiconductor pulse lamps. The system allows stabilization of the threshold and the transmission factor. This system includes the whole spectrometer channel, beginning from the photomultiplier up to the memory input. Thanks to the stabilization used, the permanent stability of the center of gravity positions of the measured time distributions is equal to ± 3.10 ^{12} sec. Author (NSA)

N69-15767*# Ohio State Univ., Columbus. ElectroScience Lab.
THE MICROWAVE RADIOMETER AS A REMOTE SENSING INSTRUMENT
W. H. Peake 17 Jan. 1969 48 p refs
(Contract NSR-36-008-027)
(NASA-CR-99102; TR-1903-8) Avail: CFSTI CSCL 04B

The fundamentals of microwave radiometry are reviewed including radiation theory, antenna effects and instrument design. The parameters of a surface which control its brightness temperature at microwave frequencies are reviewed and related to other parameters which characterize the surface. Among these, the role of the complex dielectric constant and its dependence on moisture and ion content, and the effects of surface roughness are discussed. A number of observations of the brightness temperature of terrestrial surfaces are reviewed, interpreted on the basis of model surface properties, and considered as potential applications of the instrument as a remote sensor. Author

N69-15798# National Co., Inc., Melrose, Mass.
DEVELOPMENT OF AIRBORNE TIME/FREQUENCY RANGE/ALTITUDE MONITOR Final Report
Richard A. Horn Jun. 1968 44 p refs
(Contract FA-67-WA-1650)
(SRDS-RD-68-39) Avail: CFSTI

Three feasibility models of an Airborne Time/Frequency Range/Altitude Monitor were designed, developed, fabricated, tested, and delivered to the Federal Aviation Agency. The type of system developed is ideally suited to many avionics applications. All equipment components required to implement such a system are readily available at the present time. The most novel hardware innovation of the program involved the use of metallic-oxide-substrate (MOS) shift registers for transmission and reception of start pulse groups. At the present time, the MOS approach is clearly superior to any other for the application. Author

N69-15814# Sandia Corp., Albuquerque, N. Mex.
STUDY OF PHASE TRANSITIONS IN INSULATORS BY THE DIELECTRIC CONSTANT TECHNIQUE
G. A. Samara and W. L. Chrisman Aug. 1968 27 p refs Symp. on the Accurate Characterization of the High Pressure Environ., Gaithersburg, Md.
(Contract AT(29-1)-789)
(SC-DC-68-2410; CONF-681005-1) Avail: CFSTI

Measurement of the dielectric constant and dielectric loss is proposed as the operating principle of a probe for detecting and studying the properties of pressure-induced phase transformations in insulators. The measurement is very sensitive, relatively simple, and can be adapted for use in many types of high pressure apparatus. To illustrate the general usefulness of the technique, results on a variety of substances (solids and liquids) obtained from measurements in three different pressure apparatus are presented and discussed. The substances investigated include a number of alkali and thallous halides, strontium titanate, and water. Author (NSA)

N69-15849# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
ASTRONOMICAL SATELLITE PACKAGE CONFIGURATION
D. W. Swift Paris ESRO Feb. 1967 19 p
(ESRO-TM-P-88-ESTEC) Avail: CFSTI

The aim of this paper is to collect together for convenience of reference the principal geometrical relationships governing the choice of experimental package configurstion, and also to indicate the nature of the limiting constraints on the design possibilities. ESRO

N69-15906# Joint Publications Research Service, Washington, D. C.
MEASURING MACHINE AND EQUIPMENT NOISE
G. L. Osipov et al 24 Dec. 1968 170 p refs Transl. into ENGLISH from the book "Izmereniye Shuma Mashin i Oborudovaniya" Moscow, 1968 p 1-148
(JPRS-47131) Avail: CFSTI

The basic acoustic concepts and variables are investigated. Included are descriptions of instruments for measuring the noise characteristics of machinery, and the planning and design procedures for anechoic reverberation changes for measuring the noise characteristics of machinery. The procedures which are discussed in detail are used to measure the noise characteristics of machinery in free and reflected sound fields, in ordinary surroundings using a standard noise source, and also in the near field of the noise source. Author

N69-15922# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
A SERVOED SLIP RING UNIT FOR THE SINGLE AXIS SIMULATOR
A. Robinson Paris ESRO Dec. 1966 21 p refs
(ESRO-TM-P-78(ESTEC)) Avail: CFSTI

A record is given of work carried out up to 14 October 1966 on the design and development of a Servoed Slip Ring mechanism for the Single Axis Simulator project, extended to include a torque generator, torque sensor, compensation potentiometer and coarse attitude measurement potentiometer, and several associated electronics units. The total value of parts of the unit destroyed in the fire is estimated at D.F1. 6000 and the material cost for reconstruction of the unit at D.F1. 10 000. Author (ESRO)

N69-15962*# University Coll. of North Wales, Bangor. School of Engineering Science.
DEVICE FAILURE ANALYSIS BY SCANNING ELECTRON MICROSCOPY
P. R. Thornton, I. G. Davies, D. A. Shaw, D. V. Sulway, and R. C. Wayte [1968] 70 p refs
(Grant NGR-52-117-001)
(NASA-CR-99037) Avail: CFSTI CSCL 20F

The limitations of the scanning electron microscope (SEM) method as imposed by the availability of hardware are discussed, along with the more fundamental limits due to the physical mechanisms on which the method is based. The needs of device engineers are examined to establish the ways in which these differ from the requirements of workers in other disciplines. A failure analysis facility based on an SEM is described; the approach suggested combines the SEM with more conventional techniques. Emphasis is placed on the electron optics, the specimen chamber, and the pumping system, and on the main requirements to be met by the semiconductor instrumentation console. An overview is presented on the research being conducted to extend the SEM both by the incorporation of further instrumentation and by the elimination of the more fundamental limitations. A working specification for an SEM designed specifically for the semiconductor industry is presented. M.G.J.

N69-16040# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
THE USE OF INTEGRAL COMPENSATION IN THE REACTION WHEEL CONTROL LOOP
D. N. Soo Paris ESRO Jan. 1965 15 p refs
(ESRO-TM-P-92-ESTEC) Avail: CFSTI

This study investigates the possibility of introducing integral control into the reaction wheel control loop in order to produce constant attitude error in the presence of constant disturbing torque. Integral control results in the loop becoming conditionally stable and it is concluded that at this stage such an undesirable feature is too severe a penalty to pay for the advantage of constant attitude error. However, if the control loop without integral compensation should prove to be inadequate, further study of the use of the integral control loop will need to be undertaken.
ESRO

N69-16046# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
THE OPTIMUM CONFIGURATION OF THE EXPERIMENTAL PAYLOAD OF THE L.A.S.
K. H. David Paris ESRO Oct. 1964 27 p
(ESRO-TM-P-3-ESTEC) Avail: CFSTI

Based on a theoretical measure of performance, representing the number of nepits which can be converted to the number of bits obtained by the observation of a star's spectrum, an investigation and comparison is made of a one-, two-, three- and four-mirror Cassegrain system, with no dark-current present and with very low signal-to-noise ratio. From this it is concluded that the use of the four-mirror system offers the highest information gain and guidance accuracy for technically feasible lengths of the satellite. The figure of merit used also enables the optimum resolution to be determined. It is found, however, that for brighter stars the optimum resolution $\Delta\lambda_{opt}$ lies below that required by the fine guidance accuracy. Finally, an estimate is made of the maximum capacity needed for storing the measurements (excluding indications of the wavelength position of the sampling points and storage required for redundancy). For the ideal case using the optimum resolution at most 8.10^5 bits are required. Taking a resolution of 0.2 Å, which might be considered feasible from the fine guidance point of view, at most $2.4.10^5$ bits are needed to store the results of three orbits. Finally, design parameters for the instrument are proposed. The investigation indicates that an increase of the information gain could be achieved mainly by improving the fine guidance accuracy in the case of bright stars, while the information gain from faint stars would be greatly increased if the sensitivity function of the instrument were improved.
ESRO

N69-16087*# California Univ., Los Angeles. Dept. of Engineering.
THE DESIGN AND CONSTRUCTION OF A FAR-INFRARED SPECTROMETER FOR THE SPECTRAL REGION OF 30–1600 MICRONS
T. F. Tao and A. J. Capell Mar. 1967 130 p refs
(Grants NGL-05-007-003; NSF GK-251)
(NASA-CR-99046; Rept-67-9) Avail: CFSTI CSCL 20F

A general review of previous work and short history of the development of far infrared spectrometers is presented, in addition to the discussion on the problems of its design and construction. The generation of far infrared energy by thermal and electrical sources is treated, as well as detection using thermal detectors and photodetectors. Complicating the design of this instrumentation is the fact that most thermal sources emit exceedingly small amounts of far infrared radiation relative to that of shorter wavelengths and that the energy associated with far infrared photons is very small. These features make the filtering and detecting problems more difficult. The components of the instrumentation are described, with detailed description of the various categories of filters within the two basic types used in the far infrared—transmission or reflection filters. The design of the spectrometer, which utilizes a Czerny–Turner mirror arrangement in both fore-optics and monochromator sections and incorporates all grating and filters within the instrument to be changed by remote operation, is discussed in detail. The operation, calibration, and performance of the spectrometer are then treated.
A.C.R.

N69-16097*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTAL STUDY IN VACUUM OF THE RATE-OF-RISE OUTGASSING-MEASUREMENT TECHNIQUE
Gerald L. Gregory Washington Jan. 1969 45 p refs
(NASA-TN-D-4973) Avail: CFSTI CSCL 14B

A parametric study was conducted to determine the capabilities of the rate-of-rise outgassing-measurement technique. In the rate-or-rise technique the rate of pressure rise due to outgassing in a closed volume is a measure of the outgassing rate. The study consisted in experimentally measuring, at room temperature, with the rate-of-rise technique known leak rates of nitrogen, methane, and helium gases in the leak range of 5×10^{-6} to 5×10^{-4} torr-liter-second^{-1} and in the high vacuum range of 10^{-6} to 10^{-3} torr. Nitrogen and methane leak rates were measurable to within an experimental accuracy of ±20 percent of the known leak rate; whereas helium leak rates were measurable to within an accuracy of ±25 percent of the known leak rate. Errors as large as a factor of 10 in the measurement of leak rates were found to exist as the result of ionization-gage pumping. These errors were reduced by reducing gage pumping effects. Within the experimental uncertainty of the investigation for the gases considered, adsorption phenomena were not observed to influence rate-of-rise results.
Author

N69-16099*# Denver Univ., Colo. Research Inst.
THE USE OF THERMODYNAMIC PROPERTIES OF METAL-GAS SYSTEMS AS REDUCED-PRESSURE STANDARDS
Charles E. Lundin Washington NASA Jan. 1969 34 p refs
(Contract NAS1-7391)
(NASA-CR-1271) Avail: CFSTI CSCL 14B

The erbium-hydrogen binary system was investigated by means of a Sievert's apparatus to determine the applicability of such a metal-gas system for a low-pressure standard. A thermodynamic relationship was empirically determined for the two-phase region, erbium solid solution plus erbium dihydride, for the pressure range N69-15873 10^{-4} to 10 torr and the temperature range of 550 to 950°C. This relationship, the van't Hoff equation, is a first-order equation representing the dissociation of hydrogen gas from the dihydride phase to form the metal solid solution as a function of temperature. The coefficient of determination for the data presented was computed to be 0.999. Data is presented on the feasibility of using metal-oxygen and metal-nitrogen systems as secondary low-pressure standards.
Author

N69-16100*# Boeing Co., Seattle, Wash.
SHEAR STRAIN PROPERTIES TO 10^{-10} OF SELECTED OPTICAL MATERIALS
William A. Eul and W. William Woods Washington NASA Jan. 1969 77 p refs
(Contract NAS1-7627)
(NASA-CR-1257) Avail: CFSTI CSCL 11F

The nonrecoverable (plastic) torsional strain of AISI 304L corrosion-resistant steel, CER-VIT 101, fused silica 7940, and fused silica 7971 was experimentally determined as a function of applied torsional stress. Stress and strain ranges of 200 to 10,000 psi and 0.0005 to .2 microinches per inch, respectively, were recorded. Significant differences between as-machined and annealed specimens were observed. Information obtained from this program is to be applied in the design and manufacture of large diffraction limited optics.
Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-15042# Eidgenossische Technische Hochschule, Zurich (Switzerland).
BASIS FOR ELECTROSTATIC PRECIPITATION OF HIGH RESISTIVITY PARTICLES [GRUNDLAGEN ZUR ELEKTROSTATISCHEN ABSCHEIDUNG VON HOCHOHMIGEN STAEUBEN]
Johannes Ernst Luethi (Ph.D. Thesis) 1967 111 p refs In GERMAN
(DISS-3924) Avail: CFSTI

Theoretical and experimental studies to improve the performance of industrial electrostatic dust filters centered on the construction of a new electrode system with additional disk-shaped electrodes. Time analysis of dust concentrations in such a pulsed modified filter showed improved absorptivity for dust with high electric resistance values. A 99% absorptivity for dust with 10^{11} Ohm/cm resistance makes it possible to use a six-to eight times smaller sized filter in comparison with conventional filter sizes. Transl. by G.G.

N69-15141 Wisconsin Univ., Madison.
COMPARISON OF MEASURED METAL TEMPERATURES DURING ARC WELDING WITH TEMPERATURES CALCULATED USING A FINITE HEAT SOURCE
Reza Tanbakuchi (Ph.D. Thesis) 1967 327 p
Avail: Univ. Microfilms: HC $14.85/Microfilm $3.00 Order No. 67-17035

A new approach has been introduced for predicting the temperature distribution in the base metal during welding. It consists of dividing the problem of heat transfer in welding into two parts; the first is concerned with the transfer of heat into the weld pool and the size and shape of the melting isotherm; the second, which is reported in this thesis, is concerned with the diffusion of heat from the weld pool into the solid. The governing differential equations and their boundary conditions were derived in their most general form for one-, two-, and three-dimensional cases, taking into consideration 1) variation of thermal properties, 2) radiative and convective heat losses, 3) heat generation in the base metal. Dissert. Abstr.

N69-15472 Technische Hochschule München (West Germany).
STUDY OF HELICON AND SPIROID GEARS WITH INVOLUTE WORM FLANGES ACCORDING TO HERTZ AND THE HYDRODYNAMIC THEORY [UNTERSUCHUNG VON HELICON UND SPIROID GETRIEBEN MIT ABWICKELBAREN SCHNECKENFLANKEN (EVOLVENTENSCHNECKEN) NACH DER HERTZSCHEN UND NACH DER HYDRODYNAMISCHEN THEORIE]
Stefan Lange (Ph.D. Thesis) 1967 36 p refs In GERMAN
Avail: CFSTI

Formulas and methods are presented for calculating torque moments transferable from the Hertz pressure and the lubrication pressure as well as hydrodynamic losses and efficiency of gears of various sizes. Numerical results obtained with an ALGOL program for some of the gear combinations are compared. K.W.

N69-15508# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
LEAK TESTING AND REPAIR OF HEPA FILTER BANKS
James R. DeMonbrun and E. E. Choat 10 Oct. 1968 23 p refs
(Contract W-7405-ENG-26)
(Y-JA-33) Avail: CFSTI

A routine program for handling, installing, and testing HEPA filters is described. Quality assurance testing, inspection and installation, the HEPA filter frame, in-place efficiency testing, in-place leak testing, and repairs and modifications to stop leaks are discussed. NSA

N69-15625 Illinois Univ., Urbana.
PLASTIC DEFORMATION IN METAL CUTTING
Subbiah Ramalingam (Ph.D. Thesis) 1967 227 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-8201

The plastic deformation process involved in chip formation during metal cutting is examined. Several experimental techniques were utilized to identify the material and cutting parameters which play the major part in the chip formation process. Photoelasticity/plasticity techniques and grid deformation studies were applied to polymeric work pieces to identify the operative process in amorphus solids. The data obtained is used to examine the process in metallic materials. Recrystallization studies show that a dynamic equilibrium is established between strain hardening and recovery during metal cutting which permits shear in a thin, doubly curved surface quite similar to the operative process in amorphus solids. Electron microscopy replication studies substantiate the postulated dynamic equilibrium. Electron microscopy studies extended to pseudo single crystals further emphasize the role of crystallinity and defect physics in metal cutting. Dissert. Abstr.

N69-15687# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE COMPUTATION OF THERMAL DEFORMATIONS IN SOLID AND HOLLOW CYLINDRICAL PARTS DURING MACHINING
M. F. Semo et al 20 Dec. 1967 12 p refs Transl. into ENGLISH from Politekhnicheskiy Inst. Vest. (Kharkov), no. 1, 1965 p 6-13
(AD-678368; FTD-HT-23-1229-67) Avail: CFSTI CSCL 20/11

Experiments and calculations have shown that, during machining of specimens with straight cut-off tools, the principal factor affecting the magnitude of the overall temperature error is the temperature error due to the elongation of the cutting tool. For accurate work the cutting tool length should be minimized. With increased cutting speed and feed rate the temperature of the part decreases; however, the total accompanying thermal deformation is much greater than the decreased thermal deformation of the part. Author (TAB)

N69-15850# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
DESIGN OF GAS BEARING FOR THE SINGLE AXIS SIMULATOR
H. M. Briscoe Paris ESRO Dec. 1966 32 p refs
(ESRO-TM-P-84-ESTEC) Avail: CFSTI

This paper describes the design of a hydrostatic gas lubricated bearing for supporting the rotor of the single axis simulator. ESRO

N69-15938# Road Research Lab., Crowthorne (England).
A LABORATORY METHOD OF MEASURING SLIP IN BOLTED CONNECTIONS
D. S. Moss 1968 11 p ref
(PB-179704; RRL-LR-159) Avail: CFSTI CSCL 13E

In a series of tests on high strength friction grip bolted connections having corrosion resistant treatments applied to the joint interfaces, it was necessary to measure the relative movement of the plates under applied loads in order to assess the performance of the joint. An instrument was required which would measure this movement and yet be unaffected by the strain induced in the plates by the load. As many test pieces were to be used, it was desirable that the instrument could be applied to the test piece as a unit to avoid a tedious setting up procedure. A gauge has been designed which satisfies the above requirements and in which the measurements of movements are repeatable to within 5 percent. Author (USGRDR)

N69-15949# Massachusetts Inst. of Tech., Cambridge. Engineering Projects Lab.
A NEW THEORY OF ROLLING CONTACT
P. R. Nayak and I. L. Paul Apr. 1968 156 p refs
(Contract C-85-65)
(PB-179433) Avail: CFSTI CSCL 20K

The report proposes an entirely new theory of rolling contact. Surfaces are modeled as rough (although rough in this context applies even to ball bearing smooth surfaces which are rough on the micro-scale) and are described statistically. When two rough surfaces are pressed together, their peaks (known as asperities) press against each other and form junctions. Friction in the interface is caused by the shearing of these junctions. An important result of this model is that the relationship between the dimensionless friction force and the dimensionless lateral slip velocity depends on the surface roughness of the wheel and track. This surface roughness is described by a roughness (or smoothness) parameter. The influence of the roughness on the friction is postulated and described. Finally, experimental results are presented which support the conclusions that surface roughness is a relevant paramater in rolling contact and that the force-slip relationship is strongly dependent on surface roughness. Author (USGRDR)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-15084# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATIONS OF LASERS
Ch'un Hsiang 3 Nov. 1967 11 p Transl. into ENGLISH from K'o Hsueh Hua Pao, issue 1, 1963 p 13–15
(AD-674274; FTD-HT-23-1024-67) Avail: CFSTI CSCL 17/2

Laser can produce a light beam having excellent directivity and an intensity several million times the intensity of the sun. Experiments proved that laser beams have a beam spread less than 30 cm for every 1.5-km propagation. Research in underway to use lasers in space, surface, and underwater communications. Lasers will be used in military detection, mapping, computing technology, and space navigation and also as weapons. When lasers are used in communications, the audio signals to be transmitted are used to modulate the light beams. The modulated beams are then transmitted by an optical transmitter. The optical receiver at the receiving end will receive and demodulate the incoming light signals. An optical system for space communications using solar energy for laser pumping is in process of development. Optical radars require a lower input power than microwave radars. Research shows that an optical radar having an average output power of 66 w is capable of detecting 2 spaceships 16,000 km apart with an accuracy approaching 1 x 0.0001. A ground optical radar having a 10-km detecting range weighs only 10 kg. lasers emitting blue light beams are used for underwater tracking and intersubmarine communications. Author (TAB)

N69-15174# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ON A LOW-FREQUENCY MASER AMPLIFIER [ETUDE D'UN AMPLIFICATEUR MASER BASSE-FREQUENCE]
Henry Pepin Oct. 1968 135 p refs In FRENCH; ENGLISH summary
(ONERA-P-125) Avail: CFSTI

The design is based on the dynamic polarization of the protons of a solution containing free radicals and is intended to replace conventional devices used to amplify signals originated by very low internal resistance sources. For physical measurements, a linear autodyne spectrometer was developed. With this device one can measure directly the negative resistance due to the maser effect. In this respect its possibilities are broader than those of existing spectrometers. The physical characteristics of the maser are evaluated and optimized as well as its electronic and technological elements. The study shows that it is necessary to use a system of liquid circulation. The efficiency of this system itself, and the influence of the type of flow, are particularly analyzed. The evaluation of the performance leads to the improvements to obtain an operational maser. Author

N69-15186 Maryland Univ., College Park.
A ZERO FIELD TRAVELING WAVE POWDER MASER
Gerald Edward Friedman (Ph.D. Thesis) 1967 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-6526

The theory and properties of traveling wave masers are presented and the choice of Fe^{3+} doped sapphire for the maser material is justified. An analysis of electromagnetic propagation on a sheath helix is given as an approximation to the exact analysis for the fields of the tape helix. From the sheath theory come simple design formulas which may be used as a basis for the design of the traveling wave structure. Since the properties of the helix depend on the relative permittivity of the ceramic surrounding the helix a measurement procedure is outlined for determining the dielectric constant of the rod by perturbing the resonance of a microwave cavity. Finally the techniques required to fabricate all elements of the maser are described and some experimental verification of the design is presented. Dissert. Abstr.

N69-15253# United Kingdom Atomic Energy Authority, Culham (England). Culham Translations Office.
LASERS IN PHYSICAL INVESTIGATIONS
N. G. Basov May 1968 13 p Transl. into ENGLISH from Priroda (Moscow), no. 10, Oct. 1967 p 17–23
(CTO/517; NP-tr-1696) Avail: CFSTI

The application of lasers to the generation and heating of plasma is discussed. The properties of a plasma produced by the action of a laser pulse on a carbon target in a vacuum were studied; measurements of electron density using interferometry and measurements of the square of the plasma propagation velocity are reported. NSA

N69-15504# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A 6-GW NEODYMIUM GLASS LASER
M. P. Vanyukov et al 5 Jan. 1968 5 p refs Transl. into ENGLISH from Optiko-Mekh. Prom. (Leningrad), no. 12, 1966 p 65
(AD-678463; FTD-HT-23-1611-67) Avail: CFSTI CSCL 20/5

A 6-GW neodymium glass laser with a simple photoscopic Q-switch is described. The laser consists of three cylindrical rods in series, each 250 mm long and 45 mm in diameter. Each rod is placed in a multielliptic reflector and is pumped by six direct flashlamps. The external cavity consists of one 99.6%-reflective dielectric mirror and a Q-switch placed between the first and second rods. The Q-switch consists of a cell made of two plane-parallel (error less than 1 min of arc) glass plates joined optically through

a 1-cm-thick glass ring. The cell is filled with a polymethine-dye solution to a concentration at which the solution is 99% reflective at 1.06 micrometer. At maximum pumping energies, single 100-120-j, 20-nanosec pulses were obtained. By increasing the pumping energy or by diluting the absorber solution, two or more pulses could be generated. In the case of two-pulse operation (50-80 microsec. repetition frequency), the total output was 200 j. The use of a phototropic liquid switch and large-diameter neodymium glass rods resulted in energy and power densities of 6 j/sq cm and 0.3-0.4 Gw/sq cm, respectively. TAB

N69-15505# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPERATIONAL TEST OF A MOLECULAR GENERATOR ON AN ARTIFICIAL EARTH SATELLITE
N. G. Basov et al 1 Dec. 1967 15 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 5, no. 4, 1967 p 608-616
(AD-678441; FTD-HT-23-1536-67) Avail: CFSTI CSCL 20/5

The report is a brief discussion of the first experiment in study of the operation of a maser on an artificial earth satellite. It was found that the maser operated normally at different altitudes above the earth, within and outside the earths radiation belt, when the satellite was illuminated by the sun and when it was in the earths shadow. The relative frequency stability of the maser during one observation contact was approximately equals 10 to the minus 11th power. Between contacts the maser frequency changed by a value somewhat greater than 10 to the minus 10th power. A system of two-directional radio communication with the satellite ensured the possibility of measuring the maser frequency with an accuracy to 10 to the minus 11th power. Author (TAB)

N69-15624 Illinois Univ., Urbana.
A SEQUENTIALLY MODULATED RUBY LASER SYSTEM FOR TRANSMITTED AND SCATTERED LIGHT DYNAMIC PHOTOELASTICITY
Robert Edward Rowlands (Ph.D. Thesis) 1967 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-8208

This investigation presents an ultra high-speed recording system for dynamic photoelasticity utilizing a sequentially modulated ruby laser and a smear camera. The laser is modulated by a Pockel's Cell at up to 170,000 pulses per second, the pulse widths being less than 65 nanoseconds. The laser output is synchronized with the event and camera so as to record dynamic transmitted and scattered light fringe patterns in high modulus materials at 75,000 frames per second. Dissert. Abstr.

N69-15695 Texas Univ., Austin.
ANALYSIS AND EVALUATION OF SIMPLE ELECTROMAGNETIC MODELS FOR LASER IN AXIAL MAGNETIC FIELDS AND PLANE DIFFRACTION GRATINGS
Marion Otho Hagler (Ph.D. Thesis) 1967 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-4285

By using a vector Kirchoff integral and introducing suitable approximations for the electromagnetic fields on the surface of a plane diffraction grating, the fraction of the diffracted radiation appearing in each diffraction order is calculated here. The results are given as an explicit closed form function of the shape of the grooves on the grating surface and the wavelength of the incident radiation. On the basis of the anlaysis, it is shown that for a grating with triangular grooves which are wide and shallow compared to a wavelength of the incident radiation, the maximum amount of radiation is directed into a given diffraction order when the groove shape is such that the radiation is specularly reflected from one face. Furthermore, it is shown that such a grating used in a Littrow mount exhibits no polarization effects. Finally, comparison with experimental data confirms the accuracy of the calculations in parameter ranges for which the simple model of the grating is expected to be valid. Dissert. Abstr.

N69-15914# United Aircraft Corp., East Hartford, Conn. Research Labs.
RESEARCH INVESTIGATION OF PICOSECOND OPTICAL PULSE TECHNOLOGY
Anthony J. DeMaria and William H. Glenn 21 Nov. 1968 6 p
(Contract N00014-66-C-0344; ARPA Order 306)
(AD-678383; G-920479-10) Avail: CFSTI CSCL 20/5

Research plan: Analysis of the propagation of ultrashort optical pulses; Measurement of nanosecond fluorescence decay time; Light amplification in absorbing media; Adiabatic inversion of quantum states; Optical rectification of mode-locked laser pulses at microwave frequencies; and Mode-locking of organic dye lasers. TAB

N69-15917# United Aircraft Corp., East Hartford, Conn. Research Labs.
RESEARCH INVESTIGATION OF LASER LINE PROFILES Quarterly Report, 1 Aug.-31 Oct. 1968
Anthony J. DeMaria, William H. Glenn, G. L. Lamb, Jr., M. E. Mack, and E. B. Treacy 8 Nov. 1968 21 p refs
(Contract N00014-66-C-0344; ARPA Order 306)
(AD-678382; G-920479-9; QR-9) Avail: CFSTI CSCL 20/5

Topics discussed include analytical results on the propagation of ultrashort optical pulses, experimental results on tunable mode-locked organic dye laser and investigations of stimulated scattering process in absorbing liquids. Author (TAB)

N69-15957# Naval Scientific Technical Information Center, London (England).
MULTILAYER DIELECTRIC REFLECTORS FOR OPTICAL QUANTUM GENERATORS ON BASE LEAD OXIDE AND CRYOLITE
E. G. Berzing et al Jul. 1968 6 p refs Transl. into ENGLISH from Zh. Prik. Spektroskopii (USSR), v. 5, no. 3, 1966 p 387
(AD-678446; NSTIC-TRANS-1927; NSTIC-18861/68) Avail: CFSTI CSCL 20/5

For multilayer dielectric mirrors made of alternating layers of lead oxide and cryolite the results are given of tests in the laser resonators with the output energy up to 10 joules. Multilayers are not yet destroyed at the energy densities of the order 300 j/sq cm, which is comparable to the results obtained for multilayers of sulphurous zinc and cryolite. Author (TAB)

N69-16050# TRW Systems, Redondo Beach, Calif. Quantum Physics Lab.
HIGH INTENSITY LASER PROPAGATION IN THE ATMOSPHERE
Theodore D. Holstein Sep. 1968 18 p refs
(Contract N00014-66-C-0022; Proj. Defender)
(AD-678422; TRW-05691-6009-R0-00) Avail: CFSTI CSCL 20/8

The residual absorption in the 10 micrometers window is considered to be due in large measure to the very far wings of the pure-rotational lines of H2O. Experimental data indicate the broadening is mainly self-broadening arising from binary collision between H2O molecules. In order to explain the relatively large absorption observed at 10 micrometers, studies were carried out based upon a model of hindered rotational motion (libration) in which the ordinary rotational motion is suppressed by the strong dipole-dipole force during close collisions. Present results give a cross section which is one-half the experimental value multiplied by a Boltzmann factor describing the probability of achieving a frequency-matching configuration. It was found that for the particular

model studied that this factor is too small. However, our studies indicate a variety of possible modifications which are capable of obtaining agreement with experiment. Author (TAB)

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-15234# Bettis Atomic Power Lab., West Mifflin, Pa.
STRESS-RELIEF ANNEALING OF NUCLEAR REACTOR TANKS: AN UNSOLVED METALLURGICAL PROBLEM
J. Sebille 1968 33 p refs Presented at the Panel of Experts on Recurring Inspection of Nucl. Reactor Pressure Vessels, Pilsen, Czech., 3–7 Oct. 1966
(WAPD-TRANS-95; EUR-3317.f; EURAEC-1762) Avail: CFSTI

The metallurgical aspects of stress-relief annealing requires supplementary research, the results of which demonstrate both its advisability and importance from the standpoint of vessel properties and safety. Author (NSA)

N69-15241# Union Carbide Corp., Oak Ridge, Tenn. Nuclear Div.
ELECTRODEPOSITION OF THORIUM, NEPTUNIUM, AND TECHNETIUM
G. S. Petit, J. D. Griffin, and C. A. Kienberger 17 Oct. 1968 20 p refs
(Contract W-7405-ENG-26)
(K-1761) Avail: CFSTI

Electrodeposition methods have been developed for applying very thin films of thorium oxide, neptunium oxide, and technetium metal on metal surfaces. Recovery of these materials from solution ranges from 98 to 100%. The adherent uniform films range in thickness from 0.0037 to 0.8 mg/cm^2. The materials are deposited from an ammonium oxalate or ammonium acetate solution with current densities ranging from 200 to 400 ma/cm^2. Thorium oxide and technetium metal have been deposited on several hundred disks; neptunium oxide has been deposited on several thousand. Author (NSA)

N69-15250*# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
STRESS CORROSION CRACKING OF TITANIUM ALLOYS: ELECTROCHEMISTRY OF FRESHLY GENERATED TITANIUM SURFACES Quarterly Progress Report, Jul. 1–Sep. 30, 1968
T. R. Beck 30 Sep. 1968 83 p refs
(Contract NAS7-489)
(NASA-CR-99009; QPR-9) Avail: CFSTI CSCL 11E

The electrochemistry of newly generated surfaces of titanium in acid solutions was reexamined because calculations with the electrochemical mass-transport-kinetic model for SCC in titanium indicated that a considerable fraction of the current in a crack may be carried by Ti^{+3} ions. Experiments conducted with rotating disk and ring-disk electrodes in which a titanium disk was scraped with a sapphire cutter in 6 M HCl confirmed that a large fraction of the current to the new surface can be accounted for by formation of Ti^{+3}. The previously obtained kinetic data for titanium in HCl was reinterpreted in the light of the new finding. A patch growth model for the passivating oxide layer shows some promise in fitting the kinetic data and further experiments are underway to test it quantitatively. It is expected that incorporation of the kinetics and transport equations for Ti^{+3} in the MTK model will allow higher potential drops in the crack and thus remove the only serious disagreement so far with the SCC data. Author

N69-15259# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ZIRCONIUM ELECTROPLATING ON URANIUM FROM MOLTEN ALKALI FLUORIDE SALTS
D. A. Nissen and R. W. Stromatt 1 Jun. 1968 33 p refs
(Contract AT(45-1)-1830)
(BNWL-825) Avail: CFSTI

Conditions were established under which zirconium could be electroplated onto uranium from molten alkali fluoride melts. Although good electroplates were made from several such solvents over a fairly wide range of conditions, the best results were obtained using the KF–LiF eutectic under the following conditions: current density from 20 to 40 mA/cm^2, temperatures from 625 to 675°C, and ZrF_4 concentration from 2 to 10 wt %. The zirconium plates were fine grained and non-porous up to a thickness of about 5 mils, after which isolated crystallites began to grow. It was proposed that the change in plate structure was related to chemical changes in the electrolyte. A method to prevent melt degradation was proposed, and an attempt to test the method was made. Author (NSA)

N69-15273# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE STRUCTURE AND PROPERTIES OF MOLYBDENUM COLUMBIUM ALLOYS IN THE SINGLE-CRYSTAL STATE
Ye. M. Savitskiy et al 21 Nov. 1967 9 p refs Transl. into ENGLISH from Russian
(AD-678467; FTD-HT-23-1033-67) Avail: CFSTI CSCL 11/6

The purpose of the investigation was to obtain single crystals of alloys of refractory metals free from interstitial impurities which reduce the ductility of the metal. The system molybdenum-columbium was chosen in various Mo-Cb ratios, from pure columbium. The starting material for the preparation of the alloys were vacuum melted rods of molybdenum and columbium which were melted together in the apparatus for the zone melting by electron beam. The single crystals of the alloys were obtained by two passes of the molten zone made in both directions, the last pass being made away from the original Mo-Cb rods. It was found that only by using single crystals of Mo and Cb was it possible to obtain single crystals of alloys with a high concentration of the second component. The change in hardness and electroresistance was a function of the composition, similar to that in polycrystalline alloys, the hardness being greatest at the 50-50 composition. X-ray diffraction analysis disclosed a mosaic structure of the single crystal alloys. TAB

N69-15274# Oak Ridge National Lab., Tenn. Y-12 Plant.
COMPUTER PROGRAMS FOR CALCULATING PEAK TEMPERATURE DISTRIBUTION IN WELDING
R. A. Huber, D. Bradway, C. M. Wiedemann, and P. W. Turner 16 Oct. 1968 47 p refs
(Contract W-7405-ENG-26)
(Y-1627) Avail: CFSTI

Computer programs have been developed for solving cumbersome heat-transfer equations relating to moving heat sources encountered in welding operations. The objective is to provide the welding engineer and designer with a reference that will guide them in making practical use of heat-transfer equations that describe the thermal history at weld heat-affected zones. Solutions for four types of problems are now available: (1) thermal mapping to determine the "temperature hill" enveloping the welding heat source on a semiinfinite plate; (2) determining peak temperatures at some distance from the weld centerline or from the bond line; (3) determining the surface peak temperature at an edge of a plate parallel to the weld; (4) determining the peak temperature on the bottom side of plates having partial-penetration welds. Author (NSA)

N69-15305# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE EFFECT OF HYDROSTATIC PRESSURE ON THE RECOVERY OF UNIT CELL DIMENSIONS IN IRRADIATED MOLYBDENUM
G. L. Kulcinski and H. E. Kissinger Aug. 1968 17 p refs
(Contract AT(45-1)-1830)
(BNWL-845) Avail: CFSTI

Irradiation of high purity Mo to 6.2 × 10^{18} n/cm^2 (E > 1 MeV) at 40°C results in a 0.22% lattice parameter increase. Isochronal anneals at ≤1 bar disclose that the expansion of the material recovers in three stages, 150, 400, and 750°C. Combination of this data with previously obtained electrical resistance measurements reveals that there are four recovery stages above room temperature. The designation of recovery stages has been modified: stage III (150°C), stage IV-A (400 to 425°C), stage IV-B (575°C), and stage V (750°C). Because isochronal anneals at 20,000 bars of hydrostatic pressure lower stage III to 90°C, a negative activation volume of migration is implied. The temperature for complete recovery of lattice parameter is lowered by pressure from 750°C to 350°C. Analysis of the data implies a divacancy mechanism for stage III recovery. Author (NSA)

N69-15306# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE EFFECT OF HYDROSTATIC PRESSURE ON THE RECOVERY OF ELECTRICAL PROPERTIES OF IRRADIATED MOLYBDENUM
G. L. Kulcinski Jul. 1968 36 p refs
(Contract AT(45-1)-1830)
(BNWL-844) Avail: CFSTI

High purity Mo has been irradiated at 40°C to 6.2 × 10^{18} n/cm^2 (E > 1 MeV) and subsequently isochronally annealed at two pressures, ≤1 bar and 20,000 bars. The electrical resistance increase recovers in three stages at low pressure, 150°C, 425°C, and 575°C. The activation energy for the 150°C recovery peak is 1.25 ± 0.09 eV and the order of the reaction varies from 3.4 at 135°C to 1.7 at 164°C. The effect of pressure is to lower the 150°C recovery peak to 90°C; this shift implies a negative activation volume of migration of −0.09 molar volumes for the migrating defect. The final recovery peak is lowered to 375°C under pressure and displays a pressure coefficient of −10°C/kbar. The 425°C peak is apparently also lowered by pressure, but because of its small magnitude and uncertainty in its position, more detailed data are required for analysis. Author (NSA)

N69-15309# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
HYDROSTATIC PRESSURE INDUCED ANNEALING OF DEFECT CLUSTERS IN IRRADIATED MOLYBDENUM
G. L. Kulcinski and B. Mastel Sep. 1968 28 p refs
(Contract AT(45-1)-1830)
(BNWL-846) Avail: CFSTI

Irradiation of high purity Mo to 6.2 × 10^{18} n/cm^2 (E > 1 MeV) at 40°C produces 3.7 × 10^{16} observable defect clusters/cc. The average cluster diameter is 25 to 35 Å. Postirradiation annealing at ≤1 bar causes the cluster density to decrease during stage III (150°C), increase during stage IV-A (400°C) and decrease to zero during final recovery at stage V (750°C). Isochronal recovery under 20 kbars of hydrostatic pressure shows that stage III is lowered to 90°C and stage V to 450°C. The recovery stages are compared to those obtained from previous electrical resistance and lattice parameter studies to establish a tentative model for radiation damage annealing in molybdenum. Author (NSA)

N69-15310# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
A STUDY OF PHASE EQUILIBRIA WITH PLUTONIUM–ZIRCONIUM ALLOYS
J. M. Taylor Sep. 1968 29 p refs
(Contract AT(45-1)-1830)
(BNWL-402) Avail: CFSTI

A partial Pu–Zr equilibrium diagram is presented which confirms the existence of a solid solution intermetallic zeta phase. The diagram developed differs from the equilibrium diagrams previously published. The effect of cooling rate on the retention of high temperature phases at room temperature is discussed along with heat treatments required to homogenize the Pu–Zr alloys. The stability of retained beta phase Pu with respect to temperature, pressure, and time is also presented. Author (NSA)

N69-15311# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
THE EFFECT OF HYDROSTATIC PRESSURE ON THE RECOVERY OF IRRADIATION INDUCED HARDNESS IN MOLYBDENUM
G. L. Kulcinski Sep. 1968 14 p refs
(Contract AT(45-1)-1830)
(BNWL-847) Avail: CFSTI

Irradiation of high purity Mo at ≈ 40°C to 6.2 × 10^{18} n/cm^2 (E > 1 MeV) induces a 19% increase in the Vickers hardness of the metal. Post-irradiation isochronal annealing at ≤ 1 bar results in a steady increase in the hardness which reaches 26% at 600°C. The hardness increase recovers over the 600 to 1000°C temperature range and returns to the unirradiated value at 1000°C. Isochronal anneals at 25°C and 20 kbars results in a 40% increase in the hardness over the as-irradiated value. High pressure anneals in the 80 to 400°C range do not significantly change the hardness while in the 400 to 500°C range rapid recovery occurs. The recovery of irradiation induced hardness appears to be related, in a very complex manner, to the recovery of observable defect clusters. The annealing of electrical resistance, lattice parameter, defect cluster density, and hardness increases are compared and discussed. Author (NSA)

N69-15380# United Kingdom Atomic Energy Authority, Harwell (England).
ISOTHERMAL YOUNG'S MODULUS OF UO_2 AND UO_2-MO CERMETS
N. Claussen [1968] 12 p refs Transl. into ENGLISH from Ber. Deut. Keram. Ges. (Bonn), no. 44, 1967 p 267–270
(AERE-TRANS-1094) Avail: CFSTI

Young's modulus of UO_2–Mo-cermets were determined by diametral-compression. The cylindrical samples necessary for this test were vacuum hot-pressed at 1500°C and 400 kg/cm^2. According to cermet composition, densities between 91.5% (Mo) and 97.0% (UO_2) were achieved. Measurements on 10 UO_2-samples of the same density (97.0%) resulted in a mean of 21.200 kg/mm^2 with a variation of 1%. Dependencies of Young's modulus on density were determined. Results of different compositions were recalculated for zero porosity assuming same porosity in the two phases of the cermet as in the two single components. A plot of these values versus composition lies below the theoretical predictions of Paul and Hashin which is related to bad wetting behavior between the phases and a low cohesion resulting from this. Author (NSA)

N69-15402# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Lab.
DIRECTIONAL STRAIN AND HYDRIDE ORIENTATION IN ZIRCALOY
Robert P. Marshall Oct. 1968 27 p refs
(Contract AT(07-2)-1)
(DP-1138) Avail: CFSTI

A refined "Directional Strain Parameter" (DεP-2) was developed to explain the hydride orientation in seamless Zircaloy tubing on the basis of laboratory and commercial fabrication histories. The directional strain (or fabrication) history, expressed as DεP-2, explained 93% of the observed variations in hydride orientation in the tubing. The grain size of the tubing had a marginal effect on the hydride orientation, and the location of the hydride platelets, transgranular or intergranular, was not significant in controlling the orientation. Author (NSA)

N69-15454*# Dow Chemical Co., Midland, Mich.
R&D AND EVALUATION OF A LIGHTWEIGHT, HIGH STRENGTH MAGNESIUM ALLOY Quarterly Report, 1 Aug.-1 Nov. 1968
George S. Foerster 1 Nov. 1968 15 p
(Contract NAS5-10398)
(NASA-CR-99079; QR-5) Avail: CFSTI CSCL 11F

A six pound melt of Mg-30Sc was successfully prepared, cast into a 3" diameter billet, and extruded into 1/16" x 1-1/4" strip. Quenching the strip as it emerged from the extrusion press caused severe cracking. The β content of the extrusion was significantly higher at the center of the cross section and at the nose of the strip than at the surface and butt. In spite of this apparent segregation of Sc, the extrusion had excellent properties-14.5% elongation, 52ksi yield strength, and 58ksi tensile strength--whether it was quenched or not. Modulus (≈7 x 10^6 psi) was lower than that determined previously. Four additional ternaries were evaluated on the mini-scale but offered no improvement over the alloys developed in previous work. Author

N69-15476# Chantiers de l'Atlantique Saint-Nazaire (France).
COMPARISON OF TEN LOW-ALLOY STEELS NORMALIZED AND TEMPERED FOR NUCLEAR REACTOR VESSELS Final Report
C. Leymonie, R. Bouverot, M. Lochen, and J. Hennion 22 Apr. 1968 90 p refs
(Contract EURATOM-054-61-12 RDF)
(EURAEC-2051; EUR-3994; FR-1) Avail: CFSTI

Ten steels were examined and compared, with a view to fabrication of nuclear reactor vessels. Research included transformation studies, measurement of mechanical properties after normalizing and tempering, study of stress relief, search for optimum conditions for stress relieving, and a study of overheating and possible recovery of overheated steel. It was found that some steels had a high elastic limit after normalizing and tempering (45 to 50 Hbar). One was selected for electro-slag welding tests. Various heat treatments for welded joints were tried with a view to improving the impact strength of the welds and of the heat affected zone. Under the test conditions heat treatments of the welded joints between A_c1 and A_c3 failed to produce the expected improvements, but impact strength was markedly improved by double normalizing. NSA

N69-15485# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SPALLATION THRESHOLD TESTS ON NIOBIUM, TANTALUM, AND ZIRCONIUM
G. P. Hanneman Sep. 1968 12 p
(Contract AT(45-1)-1830)
(BNWL-756) Avail: CFSTI

Niobium, tantalum, and zirconium specimens were heated to elevated temperatures in less than 8.0 x 10^{-6} sec by capacitor discharge. The ratio of heating time to thermal expansion time was maintained at unity or less to induce large tensile stresses. Single or multiple spallation was determined to occur in a plane normal to the long axis when temperature rose above a certain threshold. Spall threshold was found to be in the range of 1730 to 1860°C for niobium, 1900 to 2140°C for tantalum, and 1150 to 1200°C for zirconium. Author (NSA)

N69-15503# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPUTTERING OF STAINLESS STEEL WITH HYDROGEN IONS AND THEIR PENETRATION INTO THE SURFACE
Ye. S. Berovik et al 15 Dec. 1967 8 p refs Transl. into ENGLISH from Russian
(AD-678469; FTD-HT-23-1267-67) Avail: CFSTI CSCL 13/8

The coefficient of sputtering, alpha, of stainless steel, 18N9T, with H(+) sub 1 of 35 keV, and of penetration of the ions into the surface, eta, were detected by the method described previously (loc. cit.). Not the change in the weight of the target, delta P sub t, but the change in the weight of the collector, delta P sub c, should be used in the calculation of alpha on the other hand, in the calculation of eta the sum of the two should be used: alpha = delta P sub c/ (9.3 x 10 to the minus 23 power i/qt) and eta = (delta P sub c + delta P sub t)/(1.67 x 10 to the minus 24th power i/qt), where i is the current of the beam H(+) sub 1, q is the electron charge, and t is the duration of sputtering. At pressures p < or = 10 to the minus 9th power mm, alpha = 0.009 and eta = 0.5. The effect of CO, O, CH4, CO2, and H2O was detected. TAB

N69-15514# Bureau of Mines, Washington, D. C.
SOME STRAIN-AGING EFFECTS IN ELECTROREFINED VANADIUM
George H. Keith and H. G. Iverson Feb. 1969 30 p refs
(BM-RI-7222) Avail: Issuing Activity

Oxygen and nitrogen cause strain aging in electrorefined vanadium, as evidenced by maxima in yield and tensile strengths and by Snoek internal friction peaks. Alloys containing up to 0.22 percent oxygen and 0.11 percent nitrogen were investigated. Tensile strengths of oxygen- and nitrogen-containing alloys were 66,000 and 68,000 psi at 300° to 400° C, compared with 53,000 and 62,000 psi, respectively, at room temperature. Total elongation decreases to about 7 percent at the temperature of maximum strength. At 600° C, strain aging is not evident. Based on interstitial contents calculated from internal friction measurement, the increases in strength caused by nitrogen and oxygen were 440,000 psi per weight-percent nitrogen and 260,000 psi per weight-percent oxygen. Application of the Schoeck and Seeger treatment to the Snoek effect in these systems results in a calculated lattice distortion of 0.24 and 0.15 caused by the presence of an interstitial nitrogen or oxygen atom, respectively. Alloys containing boron or carbon were also investigated. Both elements refine the grain size but have no other effect because of their low solubility in vanadium. Author

N69-15520# Yale Univ., New Haven, Conn. Hammond Lab.
X-RAY STUDY OF DEFORMATION IN METALS AND ALLOYS Final Report
Christian N. J. Wagner Oct. 1968 17 p refs
(Contract Nonr-609(43))
(AD-677293) Avail: CFSTI CSCL 11/6

Investigations have shown that an analysis of the x-ray powder pattern peaks provides a tool to study the defect structure of crystalline materials; allowing the determination of applied or residual stresses, stacking fault probabilities, the mean square strain, and the effective particle sizes which contain the true sizes of the coherently diffracting domains and the stacking fault probabilities. This method is particularly suited for applications where transmission electron microscopy cannot be applied easily. Author (TAB)

N69-15530# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF IRON ON PHASE COMPOSITION, STRUCTURE, AND PROPERTIES OF A HEAT RESISTANT NICKEL CHROMIUM TUNGSTEN ALLOY
T. P. Baykova et al 20 Oct. 1967 11 p refs Transl. into ENGLISH from Russian
(AD-678367; FTD-HT-23-1062-67) Avail: CFSTI CSCL 11/6

The alloy EI868 was heated to 1200C for 5 min. and then cooled in water or air. Alloy EI868 hardened during aging owing to the formation of the dispersed phases: carbides M23C6, solid solns. of tungsten in chromium, or intermetallic phase Fe2W. In alloys contg. Fe greater than or equal to 20% the alpha phase was formed. Author (TAB)

N69-15536# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RHENIUM COATING OF REFRACTORY METALS BY THERMAL DISSOCIATION OF CHLORINE COMPOUNDS OF RHENIUM

A. N. Zelikman et al 21 Dec. 1967 14 p refs Transl. into ENGLISH from the Book "Vsesoyuznoye Soveshchaniye Po Probleme Reniye" Tr. Soveskch. Moscow, 1964 p 102-109
(AD-678464; FTD-HT-23-1159-67) Avail: CFSTI CSCL 11/3

The analysis of thermodynamic data has shown that among the Re chlorides or oxychlorides only ReCl5 or ReOCl4 may be considered as suitable for the obtaining of the Re deposits by thermal dissociation. The ReCl5 was prepared by chlorination of Re powder at 500-600C and purification from oxychlorides distillation at 160-180C. The Re was deposited on Mo strips from ReCl5 carried by spectrally pure Ar. The quality of the coatings was examined metallographically and visually. In the 900-1250C temperature range, the degree of Re utilization increased with the temperature of the substrate. Above 1200C it remained constant being 60 and 53% for ReOC14 and ReCl5, respectively. ReOCl4 is more suitable for deposition of Re coatings since it is stable up to 600C, while ReCl5 dissociates into ReCl5 and Cl2 even at 190-200C, thus making impossible the achievement of high Re concentrations in the gas. Therefore, higher rates of deposition per unit area of substrate can be achieved with ReOCl4. Continuous deposition of Re on moving W filaments Heated electrically to 100-1200C was carried out from ReOCl4 and ReCl5 vapors. Author (TAB)

N69-15558# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.

JOINING REFRACTORY METAL COMPOUNDS BY HOT PRESSING

John E. Kelley, Donald H. Sumner, and Hal J. Kelly Feb. 1969 31 p refs
(BM-RI-7225) Avail: Issuing Activity

The feasibility of joining refractory metal compounds to each other and to oxide ceramics by a vacuum hot press-diffusion bonding method was determined. Very satisfactory joins were made of ZrC to ZrB_2, ZrN to ZrB_2, ZrC to ZrN, and of ZrC, ZrN, and ZrB_2 to Al_2O_3. Each of these join assemblies contained a mixture layer comprising 50 weight-percent of each of the two end compounds. The mixture layer, sandwiched between each end compound, enhanced bonding and smoothed out the thermal expansion gradient between the two end members. Strength and thermal shock tests showed that the join areas of the ZrC, ZrN, and ZrB_2 joins were stronger and more shock resistant than the parent materials. Also included in the joining tests was one each of TiC to TiB_2, TiC to TiN, TiB_2 to TiN, and TiC to ZrB_2 joins. Each of these was well bonded, showing that the vacuum-hot-press method can be used for a variety of systems. Author

N69-15582# Michigan Technological Univ., Houghton. Dept. of Metallurgical Engineering.

EFFECT OF ANNEALING ON THE SUBSTRUCTURE OF COLD WORKED fcc METALS AND ALLOYS Technical Progress Report, 1 Sep. 1967-1 Sep. 1968

D. E. Mikkola et al 1 Sep. 1968 33 p refs
(Contract AT(11-1)-1431)
(COO-1431-4; TPR-4) Avail: CFSTI

The effects of annealing on the substructure of cold worked fcc metals and alloys are analyzed. The changes in substructure are related to physical properties. Materials studied are Cu-Ge alloys and Cu_3Au. X-ray line broadening and peak shifts are used to examine the substructure. Direct observation by transmission electron microscopy is used to allow a comparison of the substructure in bulk with thin foil specimens. Author (NSA)

N69-15584# Eidgenossische Technische Hochschule, Zurich (Switzerland).

THE INFLUENCE OF PRODUCTION PROCESSES ON THE PHYSICAL PROPERTIES OF LARGE-GRAINED CERAMICS [UEBER DEN EINFLUSS DER HERSTELLUNGSBEDINGUNGEN AUF DIE PHYSIKALISCHEN EIGENSCHAFTEN GROBKERAMISCHER PRODUKTE]

Thomas Gerster (Ph.D. Thesis) 1967 171 p refs In GERMAN *Its* Dissertation No. 3908
Avail: CFSTI

The effects of steam forming, drying, and firing on the mechanical properties of ceramics were studied with emphasis on resistance to frost and pressure and the insuing relationship between porosity and water absorption. Steam pressure forming increased moisture content, frost resistance, compression strength, and pore space but decreased mass homogeneity. The stable drying process in a dryer with convective flow produced ceramics with increased frost resistance and compression strength after a three day treatment. A kiln firing time of 8 to 10 hours was found most suitable for best ceramic products. Transl. by G.G.

N69-15717*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala. Propulsion and Vehicle Engineering Lab.

INVESTIGATION OF ELECTROPLATING PROCEDURES FOR MAGNESIUM LITHIUM ALLOYS

James R. Lowery and Gayle F. Mitchell 5 Dec. 1968 40 p refs
(NASA-TM-X-53805) Avail: CFSTI CSCL 13M

Methods for electroplating magnesium lithium alloys, LA-141, and LAZ-933, were investigated, and the corrosion aspects of the resultant electroplates were evaluated by using accelerated laboratory and outdoor exposure tests. A method was found that produced plating adhesion comparable in strength to that produced on magnesium alloy AZ31B which was used as a comparison. This plating adhesion was evaluated on the basis of results of conventional qualitative tests (bending, scraping, and heating) and also on the results of tests conducted to determine quantitatively the bond strength of the coating. This plating method consisted of pickling the alloy in a nitric acid solution, then treating in a modified (low pH) "Dow" zincate bath, and finally electroplating by conventional methods. Plated coatings produced by this method provided a moderate amount of corrosion protection from a high humidity environment, but considerably less protection from a salt spray environment. The coatings also provided a fair amount of corrosion protection when exposed to an outdoor (MSFC) environment. Author

N69-15745# Argonne National Lab., Ill.

THE EFFECT OF CALCIUM CONTENT IN SODIUM UPON THE CORROSION OF VANADIUM AND THE ALLOY V-10 WT. PERCENT Ti [DER EINFLUSS DES CALCIUMGEHALTES IN NATRIUM AUF DIE KORROSION VON VANADIN UND DER LEGIERUNG V-10 GEW PERCENT Ti]

G. Frees et al Sep. 1968 5 p refs Transl. into ENGLISH from J. Nucl. Mater. (Neth.), v. 25, 1968 p 347-349 Supported in part by EURATOM
(ANL-Trans-668) Avail: CFSTI

Loop studies were made on the corrosion effect of Na on unalloyed V and the alloy of V with 10% Ti. The oxide layers of

the corroded samples were analyzed qualitatively and quantitatively for Ca. The results show that the Ca is enriched from 3 to 5% in the corrosion layers with respect to the purified Na. The enrichment occurs in the outermost layers of the reaction zone of the V alloy. If the Ca content of the Na was reduced by gettering, the weight of the corrosion layers was greatly reduced. Ca traces in the Na stimulate the corrosion phenomena in V and its alloys with Ti in flowing Na. NSA

N69-15762# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
ACOUSTIC EMISSION OF ZIRCALOY-2 DURING TENSILE AND FATIGUE LOADING
T. E. Michaels Aug. 1968 30 p refs
(Contract AT(45-1)-1830)
(BnWL-727) Avail: CFSTI

The acoustic emission of Zircaloy-2 has been studied during tensile and fatigue loading at room temperature. A considerable amount of signal was received during these loading tests. Metallographic evidence relating acoustic emission to deformation processes was acquired. Author (NSA)

N69-15789# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
LATTICE DEFECTS IN STAINLESS STEEL SHOCK-LOADED TO PRESSURES ABOVE 1 MEGABAR Interim Report
Lawrence E. Murr and M. F. Rose (Naval Weapons Lab., Dahlgren, Va.) 22 Oct. 1968 4 p refs Submitted for publication
(Grant AF-AFOSR-496-67)
(AD-678412; AFOSR-68-2629) Avail: CFSTI CSCL 20/2

Recent research in lattice defects in steel due to very high pressures has indicated that the residual microhardness continues to rise to about 750 kilobars. At pressures above 800 kilobars, the hardness decreases. Author (TAB)

N69-15831*# McDonnell-Douglas Co., Newport Beach, Calif. Astropower Lab.
STRESS CORROSION CRACKING OF TITANIUM ALLOYS AT AMBIENT TEMPERATURE IN AQUEOUS SOLUTIONS Yearly Summary Report, Jul. 1967-Jun. 1968
T. L. Mackay and N. A. Tiner Jul. 1968 66 p refs
(Contract NAS7-488)
(NASA-CR-99054; SM-49105-F2) Avail: CFSTI CSCL 11F

Single edge notch specimens of Ti-8Al-1Mo-1V in duplex annealed and at 1600°F and 1700°F solution annealed were susceptible to stress corrosion cracking (SCC) in aqueous salt solutions at ambient temperature. Martensitic structures obtained by annealing specimens at 1800°F or higher and containing hydrogen up to 100 ppm were immune to SCC in aqueous salt solution. The susceptibility of alpha-beta structures, obtained by reheating martensitic structures from 1800F in the temperature range 900°F to 1450°F, to SCC was dependent on the strain rate. Specimens of Ti-8Al-1Mo-IV in duplex annealed or 1600°F solution heat treated condition, stress corrosion cracked in distilled water with 2% tritiated water but did not exhibit evidence of hydrogen pickup on the fractured faces. An alpha alloy Ti-4Al containing up to 150 ppm was immune to SCC, while Ti-8Al whether air quenched or water quenched from 1450°F was susceptible to SCC. Increasing aluminum content from 4 w/o to 8 w/o changes the dislocation arrangement from tangles to coplanar arrays in deformed material. In acicular martensitic structures, planar dislocation arrays are also observed; however, dislocation movement is restricted by retained beta with slip occurring simultaneously across several grains. The effect of aluminum appears to be related to the lowering of the stacking fault energy in alpha titanium. Author

N69-15876 Rensselaer Polytechnic Inst., Troy, N. Y.
A STUDY OF GTA WELD PUDDLE CONFIGURATION PARAMETERS WITH THE AID OF IMPULSE DECANTING
Frank John Zanner (Ph.D. Thesis) 1967 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-6997

A new technique has been developed which enables the experimentalist to study the shape and size of weld puddles at any time during the welding operation. This technique provides almost instantaneous removal of the molten weld metal from the weld puddle by impulse decanting. Decanting is accomplished by utilization of the gas blast resulting from detonation of a 22 caliber starter blank. Equipment has been constructed which synchronizes the impingement of the gas blast on the molten puddle with the instant of arc cut-off within ± 2 milliseconds. A model for the mathematical simulation of GTA welding with helium shielding gas was developed by utilizing the models for puddle length, width, and depth. This simulation model is capable of calculating the current and velocity necessary to obtain a weld puddle of the size specified by the length, width, and depth mentioned above. Dissert. Abstr.

N69-15916# Naval Scientific Technical Information Center, London (England).
CONTRIBUTION TO THE STUDY OF SEVERAL VARIABLES WHICH AFFECT THE CATHODIC PROTECTION OF STEEL.
M. A. Guillen and S. Feliu Aug. 1968 30 p refs Transl. into ENGLISH from Rev. Met (Madrid), v. 2, no. 6, 1966 p 519-532
(AD-678447; NSTIC-Trans-1907) Avail: CFSTI CSCL 11/6

The effect of a series of variables is studied which affect the cathodic protection of steel in saline solutions. In sea water the cathodic surface becomes modified with time by the formation of a magnesium-calcium deposit on the metal, thus affecting the protective current which is appreciably reduced. By studying the effects temperature, aeration, movement and current density on the formation and characteristics of such deposits, new information is obtained on the factors which govern their production. An expression which relates the distinct variables with the chemical composition of the magnesium-calcium layer is theoretically deduced. Author (TAB)

N69-15931# Oak Ridge National Lab., Tenn.
PHYSICAL AND MECHANICAL PROPERTIES OF TYPE 406 STAINLESS STEEL
H. E. McCoy Jr. Oct. 1968 39 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2263) Avail: CFSTI

Several of the mechanical and physical properties of type 406 stainless steel were evaluated. The tensile properties were determined over the range 25 to 982°C and the creep-rupture properties were determined at 704, 816, and 927°C. Oxidation tests were run in air and flowing CO_2 over the temperature range 816 to 1371°C. The oxidation rates in air and CO_2 were equivalent. The thermal expansion was measured from 25 to 982°C. Structural changes during annealing and welding were noted. Author (NSA)

N69-15974# Hawker Siddeley Aviation, Ltd., London (England).
MECHANICAL PROPERTIES OF THIN GAUGE FIRTH VICKERS F.V.520, A CONTROLLED TRANSFORMATION STAINLESS STEEL MATERIAL Final Report
Orpington, Engl. Min. of Technol. Sep. 1968 141 p refs
(Contract KS/1/0194/C.B.43(a)2)
(AD-678457; S/T-Memo-4/68) Avail: CFSTI CSCL 11/6

The report gives details and results of tension, compression, dynamic modulus, bend, fracture, creep and fatigue tests on the steel in the following conditions: (1) Supplied austenitic (fully soft), hardened by sub-zero transformation, followed by precipitation heat treatment; (2) As supplied after transformation on the strip mill production line, hardened by a low temperature treatment followed

by precipitation heat treatment; (3) Austenitic FV 520 hardened by sub-zero transformation, cold rolled and precipitated to UTS of 75-90 tonf/sq. in.; (4) Austenitic FV 520 cold rolled transformed and precipitated to give UTS of about 90 tonf/sq. in.; (5) Austenitic FV 520 transformed by conditioning at 750 deg. C followed by precipitation heat treatment. Author (TAB)

N69-16073# Commissariat a l' Energie Atomique, Cadarache (France). Section Medicale et Sociale.
CONTRIBUTION TO THE STUDY OF AN ELECTRODEPOSITION TECHNIQUE FOR PLUTONIUM [CONTRIBUTION A L'ETUDE D'UNE TECHNIQUE D'ELECTRODEPOSITION DU PLUTONIUM]
George Bataller and Claude Sapy Mar. 1968 26 p refs In FRENCH
(CEA-R-3430) Avail: CFSTI

An electrodeposition method for plutonium derived from that developed by SANDERS was studied with an improved apparatus. After an optimization of the various parameters, a study was carried out of the fluctuations in the electrodeposition yield according to the method used for separating the plutonium. Author (NSA)

N69-16079# MSA Research Corp., Evans City, Pa.
EFFECT OF HIGH-TEMPERATURE SODIUM ON THE MECHANICAL PROPERTIES OF CANDIDATE ALLOYS FOR THE LMFRB PROGRAM Quarterly Progress Report, Apr.-Jun. 1968
L. H. Kirschler, R. H. Hiltz, S. J. Rodgers, R. C. Andrews, and K. R. Barker Sep. 1968 101 p refs
(Contract AT(11-1)-765)
(MSAR-68-135; XAC-720264) Avail: CFSTI

Progress is reported on the effect of high temperature sodium on the mechanical properties of alloys in the LMFBR program. The alloys in loop form were stainless steels, sodium chromites, steels, chromium, and croloy. Field testing and calibration of meters for the determination of oxygen and carbon in the sodium loop were also accomplished. NSA

N69-16082# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OBTAINING COMPLEX THIN-WALLED PARTS MADE OF TITANIUM BY POURING INTO A CHILL MOLD
Yu. P. Gavrilenko et al 16 Feb. 1968 9 p refs Transl. into ENGLISH from Tr. Inst. Met. Akad. Nauk SSSR (Moscow), no. 9, 1963 p 270-273
(AD-678461; FTD-HT-23-1499-67) Avail: CFSTI CSCL 11/6

Permanent-mold casting of complex-shaped thin-walled titanium parts (a pump wheel with a wall thickness of 5 mm) is described. Casting was performed in a laboratory unit consisting of a vacuum arc furnace with an electrically heated graphite crucible and a permanent cast iron mold mounted inside the furnace. A forged electrode 100 to 110 mm in diameter was melted in a vacuum of 0.2-0.3 mm Hg for 2 to 3 min.; the molten metal was then poured into the mold by tilting the furnace 90 degrees. The casting was cooled in vacuum for at least 20-30 min, then air cooled. Author (TAB)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-15133# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
THE CONSTITUTIVE ELEMENTS OF COMPOSITE MATERIALS, THEIR EFFECT ON THE MECHANICAL PROPERTIES
Arthur Kh. Iablokoff Sep. 1968 107 p In FRENCH; ENGLISH summary
(ONERA-NT-128) Avail: CFSTI

Results of research aimed at improving the mechanical properties of one-directional laminates are reported. The causes for the weakening of reinforcing materials were studied, and optimum characteristics of the matrix are determined and evaluated. An examination of prestressed impregnated glass fibers revealed that the pattern of the curves $\sigma = f(\epsilon)$ of the strongest one-ply laminates indicates insufficient interface energy levels locally. Various methods for studying the interface are described. It is concluded that an equilibrium should exist between interface energy levels, deformations at the interfaces, and distribution of the matrix-reinforcing material. K.W.

N69-15287 Clemson Coll., S. C.
SURFACE AND ELECTRICAL PROPERTIES OF AN AROMATIC POLYAMIDE
James Victor Hartzog (Ph.D. Thesis) 1967 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-9021

While the electrical properties of linear polyamides have recently been the subject of extensive studies, similar studies have not been made on the related aromatic polyamides. Attention has been drawn to these polymers because they possess polyfunctionality and are of primary importance in both proteins and synthetic textiles. The purpose of this investigation was to determine the relationship between the electrical properties of an aromatic polyamide and the manner in which its electrical conductivity is affected by sorption of vapors, changes in internal structure and intermolecular interaction. The polymer chosen for the study was prepared by the direct polymerization of pyromellitic dianhydride and m-phenylenediamine. Extent of cyclization to the polyimide was controlled by regulating the heat treatment of the polyamic acid formed by the polymerization. Dissert. Abstr.

N69-15502# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF ADDITIVES SYNTHESIZED FROM DERIVATIVES OF NAPHTHENIC HYDROCARBONS
I. M. Orudzheva et al 15 Dec. 1967 7 p Transl. into ENGLISH from Russian
(AD-678395; FTD-HT-23-1252-67) Avail: CFSTI CSCL 11/8

In order to develop antioxidant motor-oil additives whose composition includes phosphorus and sulfur, monochlorides of cyclohexyl- and methylcyclohexylphosphorous acids were prepared. The chlorides obtained were subjected to condensation reactions with various alkyl phenols (C3-C10) and sulfide-disulfide alkyl phenols. The effect of the synthesized compounds on the performance characteristics of D-11 oil was investigated. Author (TAB)

N69-15647# Lowell Technological Inst. Research Foundation, Mass.
A STUDY OF HOT-STRETCHING TRANSPARENT PLASTICS Final Report
Allen S. Powell, Russell W. Ehlers, and Stephen A. Orroth, Jr. Jul. 1968 78 p refs
(Contract DA-19-129-AMC-844(N))
(AD-677384; C/OM-53; TR-69-19-CM) Avail: CFSTI CSCL 20/11

The effect of hot-stretching parameters on the uniaxial and biaxial orientation, physical properties and optical properties of transparent plastics was investigated. Stretching parameters included

draw temperature, rate of drawing, percent stretch and rate of quenching from drawing temperature. Plastics on which complete evaluation of physical and optical properties was made were polystyrene, polycarbonate and MIL-P-8184 polymethyl methacrylate.
Author (TAB)

N69-15714*# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THE KINETICS OF CRYSTALLIZATION MOLTEN BINARY AND TERNARY OXIDE SYSTEMS Quarterly Status Report, 1 Mar.–30 Nov. 1968
James F. Bacon and Robert B. Graf 1 Jan. 1969 75 p refs
(Contract NASw-1301)
(NASA-CR-99158; H910373-13; QSR-13) Avail: CFSTI CSCL 11B

Eighty-three new glass compositions were prepared and partially characterized through various property measurements such as density, modulus and fiberizability. The research program recently has comprised essentially three areas, the cordierite-rare earth and/or zirconia glass region, the UARL invert analog glass systems, and a preliminary evaluation of the mechanical properties of two-phase glass systems. Good results to date have been obtained in the UARL invert analog glass series where several compositions have been found with values for Young's modulus of 20.7, 20.19, 20.25 million psi for bulk samples, and for the 20.7 million psi samples a specific modulus of 6.82 million psi per gram per cubic centimeter. Equally good results are shown by the cordierite-rare earth and/or zirconia system with glasses having moduli of 22.36, 20.12, and 19.23 million psi for bulk samples and with a specific modulus again in hybrid units of 7.38 for the highest one of these. A promising new direction has been found based on the fact that in some glasses a second phase due to heat treatment develops so rapidly that it is present in glass fibers drawn at high rates of speed with a resultant improvement in modulus. Author

N69-16089#
ENERGY THEORY OF THE FRACTURE OF ORIENTED LAMINAR FIBERGLASS UNDER BIAXIAL COMPRESSION
V. F. Iatsenko et al [1968] 3 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 10, 1968 p 941–943
Avail: CFSTI

An equation is derived for analyzing biaxial compression of longitudinal-transverse fiberglass windings by forces acting in the direction of the principal axes of anistropy. The caluclations are related to experimental conclusions that the carrying capacity of such a material is due primarily to the tensile strength of the resin binder and that fracture under compression occurs because of shear in planes inclined to the principal plane. Good agreement is found between the experimental results and those determined from the equation, which suggests its recommendation for estimating carrying capacity, under biaxial compression, of oriented laminar fiberglass materials whose fracture is caused by rupture of the individual layers under the effect of tensile strain perpendicular to the layers. A.C.R.

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-15027# Technische Hochschule München (West Germany).
ON GENERALIZED MAIN FUNCTIONS AND LC FUNCTIONS IN R^n [UEBER VERALLGENEINERTE STAMM-FUNKTIONEN UND LC-FUNKTIONEN IM R^n]
Gerhard Heindl (Ph.D. Thesis) [1968] 61 p refs In GERMAN
Avail: CFSTI

The inversion problem of the differentiation of functions of several real variables is examined against the background of a class of lateral convergent functions encompassing the constant functions. The considerations are based on the following concept: A constant function $\Phi: G \to R$, $G \subset R^n$, G open, is called the generalized stem function of the vector field $\phi: G \to R^n$, if Φ in G can be differentiated with exception of the points of an amount contained in the combination of, at most, a countable number of (n–t)-dimensional planes E_i, i = 1, 2,..., with a gradient equaling ϕ.
Transl. by K.W.

N69-15072 State Univ. of Iowa, Iowa City.
LINEAR GRAPHS, EDGE SETS, and BOOLEAN FUNCTIONS
William Lee Reuter (Ph.D. Thesis) 1967 119 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-5980

There are numerous problems in electrical engineering and in many other areas of endeavor to which linear graph theory can be applied. Such problems are modeled by using linear graphs, and the solution often involves obtaining and utilizing certain groups of edge sets. The most commonly employed edge sets in this regard are cuts, trees, circuits, and cotrees. These edge sets are interrelated in the sense that given one complete group of edge sets for a given linear graph any of the other three groups of sets can be generated. Using a particular definition format and the concepts of Boolean algebra, it is possible to formulate a convenient and usable notation for representing the edge sets. One important result is that this notation leads to the use of concise Boolean functions to describe many of the edge-set interrelationships. Dissert. Abstr.

N69-15089# Wisconsin Univ., Madison. Mathematical Research Center.
A GENERAL METHOD FOR THE CONSTRUCTION OF INTERPOLATING OR SMOOTHING SPLINE-FUNCTIONS
P. M. Anselone and P. J. Laurent Dec. 1967 35 p refs
(Contract DA-31-124-ARO(D)-462)
(AD-674456; MRC-TSR-834) Avail: CFSTI CSCL 12/1

The spline interpolation problem was generalized by attack to an abstract minimization problem in a Hilbert space setting. In this paper, new and efficient derivations of the general existence and uniqueness theorems are given, plus a constructive procedure for obtaining the desired approximations. Several practical examples illustrate the methods. Author (TAB)

N69-15095 Yale Univ., New Haven, Conn.
A MATHEMATICAL THEORY OF COMPUTING MACHINE STRUCTURE AND PROGRAMMING
Richard Johann Orgass (Ph.D. Thesis) 1967 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-5195

This dissertation describes a formal theory of computing machines, their programs, and programming languages. This theory includes the syntax and semantics of programming languages. The mathematical foundation of this work is a system of combinatory logic. This logic is capable of dealing with strings of symbols and with functions of natural numbers. In order to determine the semantical features of programming languages, a computing machine model is constructed in the system of logic. This model can be used to describe almost any computing machine with a single central processor which can actually be constructed. A programming language is defined with respect to a computing machine. The computing machine determines the semantical features of the language. Dissert. Abstr.

N69-15103*# California Univ., Berkeley. Dept. of Industrial Engineering and Operations Research.
A PROBLEM IN OPTIMAL SEARCH AND STOP

Sheldon M. Ross Jul. 1968 70 p refs Sponsored in part by NASA
(Contract DA-31-124-ARO(D)-330; Nonr-225(53))
(NASA-CR-98810; AD-676132; ORC-68-22) Avail: CFSTI CSCL 12B

We are told that an object is hidden in one of m/m < infinity) boxes and we are given prior probabilities p sub i superscript 0 that the object is in the i superscript th box. A search of box i costs c sub i and finds the object with probability alpha sub i if the object is in the box. Also, we suppose that a reward R sub i is earned if the object is found in the i superscript th box. A strategy is any rule for determining when to search and if so which box. The major result is that an optimal strategy either searches a box with maximal value of (alpha sub i)(p sub i)/(c sub i) or else it never searches those boxes. Also, if rewards are equal, then an optimal strategy either searches a box with maximal (alpha sub i)(p sub i)/(c sub i) or else it stops. Author (TAB)

N69-15113 Stanford Univ., Calif.
COMPOUND BAYES LEARNING WITHOUT A TEACHER
Normonds Alens (Ph.D. Thesis) 1967 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-6383

The compound decision problem and the empirical Bayes problem are considered. The underlying probability densities of the unlabeled samples are specified as belonging only to a family of probability density functions. Under assumptions of identifiability and some regularity conditions, the unknown probability density functions and the frequencies of the samples are estimated from the received samples. Based on these estimates, a compound decision procedure is exhibited such that the upper bound of the difference between the risk corresponding to the compound rule and the component Bayes risk on the empirical prior probabilities converges to zero. Rates of convergence of the upper bound to zero are given for the empirical Bayes problem. In the empirical Bayes problem a nonparametric estimation is considered and, under certain assumptions, a decision rule is exhibited such that the corresponding risk converges to the optimal Bayes risk. Rates of convergence are given. Dissert. Abstr.

N69-15135 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
MATHEMATICAL THEORY OF THE BOLTZMANN EQUATION [THEORIE MATHEMATIQUE DE L'EQUATION DE BOLTZMANN]
Jean-Pierre Guiraud Oct. 1968 96 p refs In FRENCH; ENGLISH summary
(ONERA-NT-132/1968/) Avail: CFSTI

The existence and the unicity of the solutions of the linear Boltzmann equation are studied. The boundary problem examined corresponds to the movement of a gas enclosed in walls reflecting the molecules according to a very general but regular linear process, excluding in particular specular reflection. The domain of validity is that of small movements around the complete aerodynamic equilibrium. If Ω is the spatial domain, independant of time, within which the gas is contained, and if H is the Hilbert space (on the functions of molecular speed), the existence and unicity are established in the class $L^2(\Omega,H)$. This concerns the stationary movement as well as the nonstationary movement with given initial conditions. Author

N69-15136 California Univ., Berkeley.
TIME-VARYING LINEAR SEQUENTIAL MACHINES
Donald Ray Deuel (Ph.D. Thesis) 1967 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-5708

A new model is proposed for time-varying linear sequential machines (TVLSM's). This model is more general in that the dimensionality of the system is a function of time. TVLSM's are characterized in terms of matrices and matrix operations are used to compute the behavior of the machines. General response formulas for TVLSM's are developed and the relation between time-varying linear sequential circuits and TVLSM's is explained in detail. An effective procedure for minimizing TVLSM's with respect to dimensionality is described. It is shown that every TVLSM has a minimal form unique up to isomorphism. Fixed sequential machines may be constructed for certain periodic TVLSM's which are, in a sense, equivalent machines. Such machines are called fixed analogs of TVLSM's. Some TVLSM's, referred to as "pseudo-TVLSM's," exhibit terminal behavior identical to that of non-time-varying linear sequential machines (LSM's). Methods are described which make it possible to construct for any pseudo-TVLSM and equivalent LSM. Dissert. Abstr.

N69-15139 Texas Univ., Austin.
FINITE SENSITIVITY AND INVARIANCE IN DYNAMICAL SYSTEMS
Nathaniel Harris McClamroch (Ph.D. Thesis) 1967 72 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-4313

Definitions of sensitivity and invariance are formulated in terms of a nonnegative scalar measure of the performance of a dynamical system. The main emphasis is on consideration of finite errors in the dynamical system and their effect on the system performance. If a certain class of errors increases the performance measure by no more than a factor of ρ, then the system is said to be ρ-sensitive. If errors of a certain class do not affect the performance measure, then the system is said to be invariant. For a specified dynamical system and performance measure, the two basic problems considered are: For what class of errors is the system ρ-sensitive, and for what class of errors is the system invariant? Dissert. Abstr.

N69-15146 Wisconsin Univ., Madison.
THE DOUBLE SPHERICAL HARMONICS APPROXIMATION FOR CYLINDRICAL AND SPHERICAL GEOMETRIES
Chi-Chung Wang (Ph.D. Thesis) 1967 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 67-17044

Extensive numerical calculations were made to compare the DP_N approximations with different choices of the distribution of the δ-function to the P_N approximations. The results of these calculations indicated that DP_N approximations with forward δ-function coupling give the best results. As a side product of this investigation a new numerical procedure has been developed, which handles the region near the origin by a series solution of the DP_N equations which is then incorporated with Schmidt's method for other points. Dissert. Abstr.

N69-15153# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
FUNCTIONS AND DISTRIBUTIONS OF A SINGLE REAL VARIABLE. APPLICATIONS TO THE LAPLACE AND FOURIER TRANSFORMS [FONCTIONS ET DISTRIBUTIONS D'UNE SEULE VARIABLE REELLE. APPLICATIONS AUX TRANSFORMATIONS DE LAPLACE ET DE FOURIER]
Robert Legendre Oct. 1968 43 p In FRENCH
(ONERA-NT-137/1968/) Avail: CFSTI

The aim of the study is to establish the essential properties of the functions of a real variable and of the distributions that generalize them, without recourse to the abstraction of functional spaces, but by linking them to analytical functions of a complex variable. The Laplace and Fourier transforms are adapted to such a concept. Author

N69-15183# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
A CONVARIANT FORMULATION OF DIFFERENTIAL "LAWS OF CONSERVATION" IN GEOMETRICAL THEORY
V. N. Folomeshkin 1967 19 p refs In RUSSIAN
(IFVE-STF-67-54-K) Avail: Issuing Activity

A covariant method of the infinitesimal displacements in a Riemannian space is formulated. A system of equations for canonical tensors defining a closed system is obtained. The equations are the covariant generalization in case of non-Euclidean space of the usual differential conservation laws. The gravitational part of the obtained canonical energy-momentum tensor T^k_i is equal to the symmetric energy-momentum tensor of a gravitational field. The matter part is connected with the symmetric energy-momentum tensor of matter by the identity being a covariant generalization of the Rosenfeld–Belinfante relation. When passing to flat space the tensor T^k_i turns into the usual canonical energy-momentum tensor of matter. For the case of a free gravitational field the obtained equations coincide with the Bianci identities and the Einstein equations. Author (NSA)

N69-15191 Wisconsin Univ., Madison.
COMPUTER SYNTHESIS OF A CLASS OF IMPEDANCE MATRICES
Alan Budner (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-5290

The problem of concern in this thesis is the following: What are the necessary and sufficient conditions such that an n-order symmetric matrix [M] is an impedance matrix of an n-port composed of interconnected one-ports, for which the graph of the n-port with an element attached across each port contains n independent circuits. Solutions are given in terms of computer programs and synthesis techniques. The computer programs express necessary and constructively sufficient conditions such that a given matrix [M] is synthesized as an n-port with a graph of a specified class. The incidence matrix of the graph is printed out so that the graph is easily constructed. The graphs of the n-ports are restricted but these restrictions are clearly stated and do not seem to be severe. The programs also allow testing of a given matrix to determine if it is a window circuit matrix or f-circuit matrix of the specified class of graphs. Dissert. Abstr.

N69-15193 Pittsburgh Univ., Pa.
A SYNTHESIS PROCEDURE AND OPTIMAL SOLUTIONS FOR THRESHOLD FUNCTIONS
David C. Opferman (Ph.D. Thesis) 1967 165 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-4443

Research effort in the area of threshold logic is divided into the following two major areas: 1) development of a synthesis procedure for threshold functions in which linear equations are employed; 2) development of a method that defines for a threshold function, the solution space from which an optimal solution for a pre-determined criterion can be found. In the synthesis procedure, a given Boolean function of n variables is determined to be either threshold realizable or not threshold realizable. For threshold functions, the original set of 2^n linear inequalities which are defined from the given Boolean function is reduced to a set of n+1 critical inequalities by eliminating the redundant inequalities. From the set of critical inequalities, a solution can be obtained. Also the critical inequalities are employed to define the solution space from which the optimum solution is found by using the given criterion and the Simplex Algorithm. Dissert. Abstr.

N69-15217 Oklahoma State Univ., Stillwater.
THE FUNDAMENTAL STATE-VARIABLE FREQUENCY MATRIX
James Otto Matous (Ph.D. Thesis) 1967 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-8453

The vector matrix state-variable models for linear, time invariant, dynamic systems were studied for the purpose of displaying explicitly the frequency characteristics implicit in all physical systems. Linear transformation methods were employed to transform the vector matrix state-variable models into the domain which would produce the Fundamental State-Variable Frequency Matrix whose elements display the system's frequency response characteristics explicitly. The uses of the Fundamental State-Variable Matrix encompasses compensation and synthesis as well as analysis. With this basic state space development the state model can be derived for unknown systems from the system frequency-spectra test data. Dissert. Abstr.

N69-15218 Minnesota Univ., Minneapolis.
WIENER–HERMITE EXPANSION FOR STATISTICAL BURGERS' MODEL EQUATION
Ming-Yang Su (Ph.D Thesis) 1967 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-7391

The Wiener–Hermite expansion has been applied to the Burgers' model equation by Meecham and Siegel. Their results are good, but an important hypothesis was introduced in their treatment in order to simplify calculations. In this thesis the hypotheses are relaxed. The calculations are based on the system of equations governing the kernal functions of the Wiener–Hermite expansion instead of the velocity correlation used by Meecham and Siegel. One advantage of the present treatment is that all statistical properties of turbulent flows can be evaluated, once the kernel functions are obtained. Another advantage is that the roles of Gaussian part and non-Gaussian part of the nearly-normal turbulent velocity field can be examined more clearly. The system of equations for the kernel functions is of nonlinear integro-differential type, which is solved numerically as an initial-value problem. Dissert. Abstr.

N69-15224# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
HIGHER-VECTOR REPRESENTATIONS OF SEMISIMPLE LIE ALGEBRAS
A. U. Klimyk 1967 5 p refs In RUSSIAN; ENGLISH summary
(ITF-68-2) Avail: CFSTI

A relation is derived for weight multiplicities of any (not only finite dimensional) irreducible representation with an integer higher weight of a semisimple Lie algebra. This relation is used to derive a formula for characters of such representations. In the case of a finite dimensional representation the formulas obtained are identical with the Costant formula for weight multiplicities and the Weyl formula for characters respectively. The representations considered are of interest due to the fact that the closure of the spaces of these representations in a topology specially introduced brings us a part of representations of the discrete series of a real semisimple algebra. Author (NSA)

N69-15230*# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
SAMPLE SIZES FOR APPROXIMATE INDEPENDENCE OF LARGEST AND SMALLEST ORDER STATISTICS
John E. Walsh 3 Sep. 1968 8 p
(Grant NGR-44-007-028; Contract N00014-68-A-0515)
(NASA-CR-98917; AD-677047; TR-3) Avail: CFSTI CSCL 12/1

Let X sub n and X sub 1 be the largest and smallest order statistics, respectively, of a random sample of size n. Quite generally, X sub n and X sub 1 are approximately independent for n sufficiently large. Minimum n for attaining at least specified levels of independence are developed. Level of independence is measured by the maximum difference between the true values of P(X sub 1 = or < x sub 1, X sub n = or < x sub n) and the corresponding

values assuming independence of X sub n and X sub i. The results are for small maximum differences (say, at most .02) and apply to all possible distributions for the population sampled. The value of minimum n is the smallest allowable n for the continuous case but can be too large otherwise. Minimum n if finite for all nonzero differences. Author (TAB)

N69-15242# Argonne National Lab., Ill.
NUMERICAL INVERSION OF FINITE TOEPLITZ MATRICES AND VECTOR TOEPLITZ MATRICES
Erwin H. Bareiss Jun. 1968 16 p refs
(Contract W-31-109-ENG-38)
(ANL-7440) Avail: CFSTI

A method is introduced by which the exact numerical inversion of finite Toeplitz matrices can be accomplished simply, using in the order of n^2 multiplications. Some efficient algorithms are given. Extension is made to vector Toeplitz matrices which occurred in the author's work. NSA

N69-15275# Los Alamos Scientific Lab., N. Mex.
THE SIMULATION OF TWO ARITHMETIC STRUCTURES
R. C. Blandford and N. Metropolis 8 Oct. 1968 9 p refs
(Contract W-7405-ENG-36)
(LA-3979) Avail: CFSTI

Two classes of arithmetic are incorporated, by programming, into a computer. The first, significant-digit arithmetic, provides for the monitoring of precision in a computation. The second, specified-point arithmetic, is a generalization of the conventional fixed-point type. The implementation is discussed. As an application of the first type, a new technique is described for function evaluation based on polynomial approximation. Author (NSA)

N69-15353# Temple Univ., Philadelphia, Pa. Dept. of Mathematics.
DISTRIBUTION OF PRODUCT AND QUOTIENT OF BESSEL FUNCTION VARIATES
Samuel Kotz and R. Srinivasan Apr. 1968 20 p refs
(Grant AF-AFOSR-68-1411)
(AD-677288; AFOSR-68-2182) Avail: CFSTI CSCL 12/1

The technique of Mellin transforms is used to obtain the distributions of the product and quotient of two independent Bessel function random variables. Two different types of Bessel function variates are considered. Applications of the results are given for the following special cases: chi-squared distributions, non-central chi-squared distributions, randomized gamma distributions, and folded Gaussian distributions. Author (TAB)

N69-15419# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ARRANGEMENT OF A GRAPH IN A PLANE
G. S. Plesnevich 2 Nov. 1967 10 p ref Transl. into ENGLISH from Akad. Nauk SSSR, Sibirsk. Otd. Inst. Mat., Vychislitel'nyye Sistemy (USSR), no. 6, 1963 p 45–53
(AD-678431; FTD-HT-23-1029-67) Avail: CFSTI CSCL 9/2

The following two problems arise in the automatic designing of computers: (1) Find an effective algorithm applicable to any graph G and determining whether or not the graph is planar; (2) Find an effective algorithm applicable to any planar graph G and determining the cyclic orders induced by a certain planar realization of the graph G. It is proven that, in solving the above problems, it is sufficient to find the graphs which possess these properties: (a) the graph has no coupling point; (b) the degree of each node is not less than 3. Two lemmas are proven: (1) if the graph G is planar, then for any of its cycles micro, the graph R micro will be bichromatic; (2) if the graph R micro, a planar realization exists which induces this hue. On the above basis, a method of constructing a system of cycles with their bichromatic hues is described. TAB

N69-15422# Stanford Univ., Calif. Dept. of Statistics.
ESTIMATING THE PARAMETERS OF A LINEAR FUNCTION OF A RANDOM VARIABLE
Stanley L. Sclove and John Van Ryzin 30 Jun. 1968 21 p refs
(Contract Nonr-225(52))
(AD-673973; TR-138) Avail: CFSTI CSCL 12/1

Suppose we have a sample of independent observations which are values of a linear function of a random variable, and we wish to find maximum likelihood estimators for the two parameters of the linear function. If the support of the random variable is the whole real axis, the maximum likelihood estimators can be found by the usual methods; in other cases restricted maximization techniques must be used. We restricted attention to the cases in which the support is an infinite interval or a lattice and the density of the random variable is non-increasing over the support. Special attention is given to the exponential and geometric distributions. If the parameter of the distribution is also unknown, its maximum likelihood estimator can also be obtained, when the support of the random variable is a lattice. (Author (TAB)

N69-15425*# Stanford Univ., Calif. Dept. of Operations Research.
ON SELECTION PROCEDURES BASED ON RANKS: COUNTEREXAMPLES CONCERNING LEAST FAVORABLE CONFIGURATIONS
M. Haseeb Rizvi and George G. Woodworth 28 Oct. 1968 22 p refs
(Grant NGR-36-008-040; Contracts Nonr-225(53); FH 11-6667)
(NASA-CR-98919; AD-677313; TR-114) Avail: CFSTI CSCL 12/1

The paper is concerned with certain multiple-decision procedures based on ranks which have been proposed for analyzing data in a one-way layout: X sub ij = theta sub i + epsilon sub ij, i = 1,...,k, j =1,...,n where the errors (epsilon sub ij) are independent, have the same known cumulative distribution function (cdf) F and where theta = (theta sub 1,...,theta sub k) is unknown. Two problems are considered: (1) Select the indices of the t largest theta-values. (2) Select a subset containing the index of the largest theta-value. Author (TAB)

N69-15501# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RESONANCE IN ROTATING SYSTEMS
L. D. Akulenko et al 15 Dec. 1967 9 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1: Mat. i Mekhan. (Moscow), no. 1, 1967 p 12–16
(AD-678475; FTD-HT-23-1436-67) Avail: CFSTI CSCL 12/1

The paper is concerned with m/n-resonance steady-state rotations of some perturbed systems governed by second-order equations. The results are applied to some practical problems. TAB

N69-15518# Brown Univ., Providence, R. I. Div. of Applied Mathematics.
THEORY OF DYNAMICAL SYSTEMS REPRESENTED BY DIFFERENTIAL EQUATIONS AND ALGEBRAIC STRUCTURES Final Scientific Report
Leonard Weiss Oct. 1968 4 p refs
(Grant AF-AFOSR-1346-68)
(AD-677290; AFOSR-68-2209) Avail: CFSTI CSCL 12/1

The report describes activity during the reporting period in the following areas: Controllability of systems with time delay; Structure and realization theory for linear systems; Finite time stability. TAB

N69-15533# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.
SENSITIVITY ANALYSIS OF DISCRETE FILTERING AND SMOOTHING ALGORITHMS

Robert E. Griffin [1968] 13 p refs Presented at the AIAA Guidance, Control and Flight Dyn. Conf., Pasadena, Calif., 12–14 Aug. 1968 *Its* AIAA Paper No. 68-824
(Contract F44620-68-C-0023)
(AD-677454; AFOSR-68-2045) Avail: CFSTI CSCL 12/1

Two problems which occur when filtering or smoothing methods are applied to an actual problem are the choice of the prior statistics and the choice of a mathematical model for the system. The model must be complete enough for an adequate description of the system and also sufficiently simple such that the resulting algorithms are computationally feasible. A major tool in both analyzing the effects of these choices and in making the best choice is a sensitivity analysis of the algorithms required in the solution of the filtering and smoothing problems. This investigation presents a complete and definitive sensitivity analysis of the discrete smoothing problem. Algorithms are developed for matrix sensitivity functions for both large and differential errors. Two examples are presented to illustrate the use of the given algorithms: a linearized version for the in-track motion of a satellite traveling in a circular orbit, and a simplified version of an error model of a long term inertial navigation system which might be used for marine application.
Author (TAB)

N69-15539# Union Carbide Nuclear Co., Oak Ridge, Tenn. Computing Technology Center.
PROPERTIES OF ESTIMATORS FOR THE GAMMA DISTRIBUTION
K. O. Bowman and L. R. Shenton 27 Sep. 1968 50 p refs
(Contract W-7405-ENG-26)
(CTC-1) Avail: CFSTI

The gamma distribution $f(x) = (x/a)^{\rho-1} (\exp-(x/a))/a\Gamma(\rho)$ is widely used in statistical application, such as life testing procedures, and especially recently in connection with cloud seeding and other weather modification experiments. The maximum likelihood estimators ($\hat{a}$, $\hat{\rho}$) are known to be sufficient estimators, but little, apart from asymptotic normality, is known about their distributional properties in finite samples. Expressions for the first four moments of $\hat{a}$ and $\hat{\rho}$, as far as terms of order n^{-2}, the sample size being n have been derived. In particular, exact expressions are given for the n^{-1} terms in the biases of $\hat{a}$ and $\hat{\rho}$, and for the n^{-2} terms in the covariances. It is indicated how deficient the first order asymptotics are (first order referring to the dominant term), and how quickly asymptotic normality is reached. Exact expressions for the first four moments of the moment estimator of a, and comment on the moment estimator of ρ are given. The results have been verified, as far as this is feasible, through Monte-Carlo simulations, and where possible through alternative algebraic approaches.
Author (NSA)

N69-15551# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON A CLASS OF SELECTION AND RANKING PROCEDURES
Shanti S. Gupta and S. Panchapakesan Sep. 1968 40 p refs *Its* Mimeograph Ser. No. 171
(Contracts Nonr-100(26); F33615-67-C-1244)
(AD-677297) Avail: CFSTI CSCL 12/1

The paper presents a brief survey of subset selection procedures for various univariate and multivariate populations. Some new results concerning the expected size of the selected subset are given in Section 2. Tables of constants for various procedures are briefly excerpted from the relevant papers.
Author (TAB)

N69-15571# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ADMISSIBLE DESIGNS FOR POLYNOMIAL SPLINE REGRESSION
W. J. Studden and J. D. Vanarman Oct. 1968 31 p refs *Its* Mimeograph Ser. No. 172
(Contract Nonr-1100(26); Grant NSF GP-8986)
(AD-677298) Avail: CFSTI CSCL 12/1

Given f = (f sub o,...,f sub m) on the closed interval a,b we consider the matrix M(mu) = integral (f'f d mu) for any probability measure mu on the closed interval a,b. The measure mu is called admissible if there does not exist a nu such that M(nu) - M(mu) is positive semi-definite and not equal to 0. A theorem is given.
TAB

N69-15603 Oklahoma State Univ., Stillwater.
OPTIMUM PASS-FAIL TESTING DECISIONS
William Carl Mc Cormick, Jr. (Ph.D. Thesis) 1967 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-8457

Methods of determining optimum sampling plans when a binary decision is to be made have been investigated. Binomial sampling was assumed as was a Beta a priori distribution for the random variable P, the binomial parameter. Appropriate loss functions and a priori estimates of the Beta parameters were also assumed. The random variable P was initially considered as time invariant. Classical statistical decision theory and the Bayesian method were first applied to determine an optimum predetermined sample size. A sequential policy for this time invariant case was then developed using dynamic programming techniques with the Bayesian decision theory formulation.
Dissert. Abstr.

N69-15627 Oklahoma State Univ., Stillwater.
TIME DOMAIN COMPENSATION OF LINEAR SYSTEMS
Jerry Graham Mrazek (Ph.D. Thesis) 1967 188 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 68-8467

A design tool was developed that permits the designer to work directly with the physical parameters of a dynamic system in order to accomplish an acceptable step response. The method involves writing the state model of the system from an operational block diagram. The state model is then transformed to the normal form, for convenience, where a transient response criterion is developed. The variable elements of the differential state transition matrix are then adjusted to attain as nearly as possible the desired transient criterion. Examples are included to illustrate the interpretation of the adjusted elements of the state model in terms of hardware. A computer program was written to perform the design procedure and to provide the printout information required by the designer.
Dissert. Abstr.

N69-15640# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
ON EXISTENCE OF G-ERGODIC VECTOR STATES
V. P. Gachok 1968 24 p refs
(ITF-68-9) Avail: CFSTI

A study is made of G-invariant vector states generated by positive-definite functionals over a normed algebra with involution Σ, whose elements are vectors $f = \{f_0, \ldots, f_n(x_1, \ldots, x_n), f_n(x_i \ldots x_n)\}$ being certain test functions. A topology is introduced in which every functional over Σ is quasianalytical and belongs to the Fock space distributions. These conditions provide for the existence of measures generating vector states. It is shown that any vector state can be approximated by extremal points (G-ergodic vector-states) of the set of G-invariant vector states in the weak topology.
Author (NSA)

N69-15648# University of Southern Calif., Los Angeles. Electronic Sciences Lab.
DISJOINT CYCLES FROM THE DE BRUIJN GRAPH
Harold Marvin Fredricksen Jun. 1968 92 p refs
(Contract DA-ARO-D-31-124-G929)
(AD-677377; USCEE-275) Avail: CFSTI CSCL 9/2

The purpose of this paper is to investigate the cycle sets of the deBruijn graph resulting from the output of a general feedback function. The distribution of possible cycle decompositions categorized by the weight of their truth tables and the number of cycles is given. Particular cycle decompositions are considered in more detail. Specifically considered are the distribution of the

deBruijn cycles, the decomposition of the graph into a single cycle, and the decomposition of the deBruijn graph into the maximum number of cycles possible. Author (TAB)

N69-15691*# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
ON SOME FURTHER PROPERTIES OF NONZERO-SUM DIFFENTIAL GAMES
A. W. Starr and Y. C. Ho Nov. 1968 26 p refs
(Grant NGR-22-007-068; Contract N00014-67-A-0298-0006; Proj. NR-372-012)
(NASA-CR-99045; TR-577) Avail: CFSTI CSCL 12A

The general nonzero-sum differential game has N players, each controlling a different set of inputs to a single nonlinear dynamic system and each trying to minimize a different performance criterion. Several interesting new phenomena arise in these general games which are absent in the two best-known special cases (the optimal control problem and the two person zero-sum differential game). This paper considers some of the difficulties which arise in attempting to generalize ideas which are well-known in optimal control theory, such as the "principle of optimality" and the relation between "open-loop" and "closed-loop" controls. Two types of "solutions" are discussed: the "Nash equilibrium" and the "noninferior set". Some simple multistage discrete (bimatrix) games are used to illustrate phenomena which also arise in the continuous formulation. Author

N69-15747*# Techtran Corp., Glen Burnie, Md.
MATHEMATICAL METHODS OF CONSTRUCTING NEW MODELS OF CONTINUA
L. I. Sedov 1968 86 p refs Transl. into ENGLISH from Usp. Mat. Nauk (Moscow), v. 20, no. 5(125), Sep.-Oct. 1965 p 121-180
(Contract NAS5-14826)
(NASA-CR-99131) Avail: CFSTI CSCL 12A

The theoretical considerations in developing mathematical models are discussed and include the identification of the problem areas, the selection of data to be included, and the methods to be used. The need for developing new models arising from the development of new trends in the mechanics of gases, liquids, solids, and composite media is emphasized. In constructing models of continua it is advantageous to use the general conditions pertaining to continuity and differentiability as well as the postulates regarding the lack of relationships (between geometric or kenematic parameters). The specific events considered are mentioned below. Geometric and kinematic characterization of the deformation of small particles of material continuums is formulated using tensor concepts. Equations are derived in a three dimensional form for the impulses and momenta in a media. Applications of the variation principles and their results within the framework of the special theory of relativity are applied to electromagnetic concepts. The functions involved in the equations of energy and heat inflow are clarified. Macroscopic continuous motion of a material medium, interacting with an electromagnetic field, is considered. B.P.

N69-15752*# California Univ., La Jolla. Dept. of Applied Electrophysics.
APPROXIMATE CALCULATION OF CUMULATIVE PROBABILITY FROM A MOMENT-GENERATING FUNCTION
Carl W. Helstrom [1968] 7 p refs
(Grant NGR-05-009-079)
(NASA-CR-99051) Avail: CFSTI CSCL 12A

A numerical method is presented for calculating the cumulative distribution of a positive random variable from its moment-generating function. It involves an expansion of the rectangular function in Laguerre functions. As examples, the cumulative exponential and cumulative Poisson probability functions are approximated. Author

N69-15756*# Michigan State Univ., East Lansing. Dept. of Mathematics.
SOME ONE-DIMENSIONAL PROBLEMS IN A THEORY OF MECHANICALLY AND THERMALLY INTERACTING CONTINUOUS MEDIA
Charles J. Martin 1 Dec. 1968 84 p refs
(Grant NGR-23-004-041)
(NASA-CR-99142) Avail: CFSTI CSCL 12A

Using a linearized theory for the mixture of elastic solid and viscous fluid, two one-dimensional boundary value problems are studied. The first problem is that of a stress-free halfspace to the face of which a transient temperature is applied. The second differs from the first in that its face is constrained rigidly against motion. With the aid of the Laplace transform, solutions of these problems are given analytically and graphically when the temperature on the boundary is (a) a delta function, (b) a step function, and (c) a ramp load. A comparison of results using this theory and the results for the corresponding thermoelastic theory is made. Author

N69-15777# Stanford Univ., Calif. Dept. of Operations Research.
DIFFUSION APPROXIMATIONS IN COLLECTIVE RISK THEORY
Donald L. Iglehart 8 Jul. 1968 16 p refs
(Contracts N00014-67-A-0112-0031; Nonr-225(53); Grant NSF GP-8790)
(AD-678413; TR-1) Avail: CFSTI CSCL 12/2

Collective risk theory is concerned with the random fluctuations of the total assets of an insurance company. The company has an initial capital u and policyholders pay a gross risk premium of a per unit time. At the jumps of a renewal process claims are made against the company for random amounts with the average claim being mu. A sequence of risk reserve processes which measure the companies assets at time t are defined and the theory of weak convergence of probability measures on function spaces is applied to show that the sequence converges weakly to a limiting diffusion process. This diffusion is Brownian motion with a drift. Weak convergence theory also yields a limit theorem for the distribution of time to ruin. The density for this limit distribution is given explicitly. Author (TAB)

N69-15832#
SPECTRAL DECOMPOSITION OF ISOTROPIC RANDOM FIELDS
M. I. Iadrenko [1968] 3 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR (Kiev), no. 9, 1968 p 835-837
Avail: CFSTI

Three theorems for indicating spectral decomposition of an isotropic random field in Euclidean space are derived. A.C.R.

N69-15871# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SIMULATION OF RANDOM NUMBERS ON AN ELECTRONIC DIGITAL COMPUTER
V. A. Kikharev et al *In its* Radar Theory and Tech. 29 Dec. 1967 p 10-21 refs (See N69-15869 05-07)
Avail: CFSTI

Methods are received of obtaining random number sequences with a given law of distribution by means of uniformly distributed random numbers. Output programs of the latter are presented on a high-speed computer. As examples, a description is given of the derivation of one-dimensional normal, exponential, Rayleigh and generalized Rayleigh laws, as well as of the results of the verification of the correlation of uniform distribution, of the coincidence of normal and given distributions, and of an evaluation of the numerical characteristics by the method of confidence intervals. Author

N69-15875 Auburn Univ., Ala.
ORDINARY DIFFERENTIAL EQUATIONS IN BANACH SPACES
Norma Mary Placum (Ph.D. Thesis) 1967 43 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-5439

A study is made of ordinary differential equations in a complete Banach space. It is shown that certain partial differential-integral equations in Euclidean n-space can be interpreted as ordinary differential equations with unique solution in a larger space, such as the space of continuous functions from a number interval. Dissert. Abstr.

N69-15877 Wisconsin Univ., Madison.
COMPUTATIONAL METHODS IN OPTIMIZATION PROBLEMS
Chang-Man Park (Ph.D. Thesis) 1967 269 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.50 Order No. 67-16995

In this investigation, three major subjects are discussed: (1) the theory of conjugate functions and optimization, (2) the second-order gradient method, and (3) the conjugate gradient method. The conjugate functions are defined utilizing the "duality principle" of convex set theory. The theory of conjugate functions is applied to optimization problems, resulting in elegant analytic solutions for linear problems, and the necessary conditions of optimality for nonlinear problems. Second-order gradient methods are developed from a second order expansion of the objective function. The inclusion of second order terms ensures fast convergence of the algorithm to the optimal solution. The conjugate gradient method is developed utilizing the Gram–Schmidt orthogonalization procedure. In this algorithm a successive search is made in the conjugate gradient directions in a Euclidean space spanned by the control variables. Dissert. Abstr.

N69-15880# Washington Univ., Seattle. Dept. of Mathematics.
NERVES OF SIMPLICIAL COMPLEXES
Branko Grunbaum Sep. 1968 24 p refs
(Contract N00014-67-A-0103)
(AD-678335; TR-7) Avail: CFSTI CSCL 12/1

If a simplicial complex K is considered as covered by its maximal (closed) faces, its nerve N(K) may be defined in the usual manner. Generalizing known results on interchange graphs of graphs, simplicial complexes which are nerves of d-dimensional simplicial complexes are characterized. Additional results on the nerves of complexes are obtained, including the existence of a duality between K and N(K) for a large and natural class of complexes K. Author (TAB)

N69-15952# California Univ., Berkeley. Statistical Lab.
INTENSIVE RESEARCH IN PROBABILITY THEORY Final Scientific Report
David A. Freedman Nov. 1968 6 p
(Grant AF-AFOSR-1318-67)
(AD-678445; AFOSR-68-2625) Avail: CFSTI CSCL 12/1

During the period of this Grant AF-AFOSR 1318-67, 25 Sep 67 through 24 Sep 68, the principal investigator, D. A. Freedman, solved three of four proposed problems on Markov chains: describing the semigroup, constructing the sample functions and interpreting the derivative. This work has been published; abstracts and references are incorporated in this Report. The principal investigator also completed a joint paper with D. Blackwell on an auxiliary question, which has been accepted for publication. An abstract is incorporated in this Report. The principal investigator also completed the first draft of a monograph on Markov processes, wrote a second draft and is presently writing a third draft. It is expected that this monograph will be published in some eighteen months, by Holden-Day of San Francisco, California. Author (TAB)

N69-15968#
ON A CLASS OF INTEGRAL REPRESENTATIONS AND SOME ESTIMATES OF BESSEL FUNCTIONS
N. V. Sionovskii [1968] 5 p refs Transl. into ENGLISH from Vychisl. Matem. i Matem. Fiz. (USSR), v. 8, no. 5, 1968 p 1101–1105
Avail: CFSTI

Estimates of integrals containing Bessel functions are obtained by using inequalities which are an asymptotic representation of the function. For large values of the parameter in the function, these estimates acquire a form from which some reinforcement of the analog of the Riemann–Lebesgue lemma for the Bessel functions follows. The estimates are obtained by using a class of integral representations of the Bessel functions which is similar to the Schloeffli formulas. Some recursive relationships convenient to obtaining new, and to reinforcing known, estimates of the Bessel functions follow from these integral representations. Author

N69-15976# Joint Publications Research Service, Washington, D. C.
DIFFERENTIAL GAMES AND COMPUTATION SYSTEMS
16 Dec. 1968 35 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Tekhn. Kibernetika (Moscow), no. 5, 1968 p 20–33, 107–114
(JPRS-47091) Avail: CFSTI

A discussion of methods of solving differential games is presented with players informed to a different degree. The controlled process is described by a system of differential equations in vector form, and controls are selected so that no criterion is optimized. Two conflicting systems are studied; the conflicting nature of the interests of the systems consisted in the fact that one of them wanted to achieve the least value of the criterion at the end of the process, and the other strove to make this value the greatest. Several characteristic cases of the tactical informed state of the systems and the effect of this informed state on the procedure for determining optimal controls are investigated. The organization of operation of a decentralized computer system of the homogeneous type is discussed. The interest in computation systems of this kind is connected with the problem of creating highly reliable control systems capable of functioning even under the conditions of breakdown of the majority of the system computers. B.P.

N69-16080#
DIFFERENCE METHODS OF SOLVING THE NAVIER–STOKES EQUATIONS (SURVEY)
I. Iu. Brailovskaia et al [1968] 18 p refs Transl. into ENGLISH from Vychisl. Metody i Programmirovanie (Moscow), no. 11, 1968 p 3–18
Avail: CFSTI

Based on a literature survey, an assessment is made of the relative advantages and problems connected with difference methods of solving the Navier–Stokes equations. These include: (1) approximate boundary conditions, (2) explicit schemes for the stationary (ζ, ψ) system, (3) explicit schemes for nonstationary (ζ, ψ) systems (4) implicit difference schemes for the nonstationary (ζ, ψ) system, (5) difference schemes for the stationary ψ equation, (6) schemes for the nonstationary ψ equation, (7) schemes for the (u, v, p) system, and (8) difference schemes to analyze viscous compressible gas flow. An extensive bibliography is included. M.G.J.

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-15314# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
WIND SHEAR AND REFLECTIVITY GRADIENT EFFECTS ON DOPPLER RADAR SPECTRA: REMOTE ATMOSPHERIC PROBING PROJECT
Peter W. Sloss and David Atlas 22 Jan. 1968 47 p
(Grant NSF GA-919)
(TR-3) Avail: Issuing Activity

The nature of the Doppler spectrum, its variance, and the associated autocorrelation function for the generalized case in which there is shear of the cross-beam motion and a gradient of the scatters' reflectivity is discussed. The spectrum is generated numerically, while the variance and autocorrelation function are derived analytically. It is found that for a linear vertical wind shear and an exponential variation of reflectivity with height, the variance of the Doppler spectrum may be increased by as much as 250% or decreased by as much as 72%, depending on whether the wind speed and reflectivity increase in the same or opposite directions, respectively. These variations result in changes from the gaussian Doppler spectrum expected from a uniform crosswind and a gaussian beam profile. The effects of vertical wind and reflectivity gradients increase with the linear vertical dimension of the radar beam, and so with both the angular vertical beam width and range. For beams of 3 degrees or less, the variance is determined essentially by the horizontal crosswind and beamwidth at ranges out to about 20 km for all significant values of shear. At larger ranges wind and reflectivity gradients become significant. Author

N69-15491# Reynolds Electrical and Engineering Co., Inc., Mercury, Nev.
WEATHER AND SURFACE RADIATION PREDICTION ACTIVITIES FOR THE STERLING EVENT—PROJECT STERLING Final Report
R. H. Armstrong and J. R. Morrell Jul. 1968 28 p refs Prepared for AEC
(Proj. Sterling)
(VUF-1037) Avail: CFSTI

In support of the Project Sterling Technical and Safety Programs, the Air Resources Laboratory–Las Vegas, Las Vegas, Nevada, provided meteorological services which included the compilation of climatological summaries, a program of surface and upper air meteorological observations, and the preparation of weather and radiation predictions. These services are described and weather and radiation chronologies, relevant to shot-day, are recounted. Author (NSA)

N69-15556# Joint Publications Research Service, Washington, D. C.
ELECTRONIC COMPUTER FOR IDENTIFYING CLOUDS
D. M. Sonechkin 2 Jan. 1969 12 p Transl. into ENGLISH from Russian Presented at the UN Conf. on the Exploration and Peaceful uses of Outer Space, New York, 13 Jun. 1968
UPRS-47170; A/CONF-34/II.11) Avail: CFSTI

Electronic computer processing of cloud cover photographs obtained from satellite television systems is discussed, and the steps involved in the processing of such photographs are enumerated. The use of computers affords opportunities for speeding up and improving upon the quality of processing television information. These factors are of increasing importance, since the volume of meteorological data obtained via television has become much greater than that collected by ground station networks. The complexities of the processing procedures are emphasized, and the functions of digital and analog computers and automatic plotters are described. A special problem which must be solved is the identification of the cloud cover itself on the television photographs, an operation complicated by the great number of cloud cover types and the various kinds of earth surface backgrounds. A.C.R.

N69-15700*# Techtran Corp., Glen Burnie, Md.
METEOROLOGICAL INVESTIGATIONS WITH THE AID OF ARTIFICIAL EARTH SATELLITES
I. P. Vetlov 1968 41 p Transl. into ENGLISH from Meteorol. i Gidrol. (Leningrad), 1967 p 27–50
(Contract NAS5-14826)
(NASA-CR-99123) Avail: CFSTI CSCL 04B

A summary of Soviet meteorological investigations using artificial earth satellites is presented. The problems involved with establishment of space meteorological systems to transmit data on a planetary scale and the need for highly efficient electronic equipment to process this data are emphasized. The scientific instrumentation and observations made by Cosmos 122, 144, and 156 satellites are described, as well as those for the experimental Meteor series, which consisted of orbiting Cosmos satellites and a network of ground stations for reception, analysis, and transmission of the information. The complex ground system required for analysis of satellite transmitted data is then described. A.C.R.

N69-15715*# Language Service Bureau, Inc., Washington, D. C.
PROBLEMS RELATING TO INTERPRETATION OF WEATHER SATELLITE DATA
M. I. Yudin, ed. et al 1967 422 p refs Transl. into ENGLISH of the book "Trudy Glavnoy Geofizicheskoy Observatorii Imeni A. I. Voyeykova (no. 166)" Leningrad, Gimiz, 1964 p 1–418
(Contract NAS5-8010)
(NASA-CR-99101) Avail: CFSTI CSCL 04B

The collection presents works carried out in 1961–1962, devoted to problems of the study of the atmosphere by means of weather satellites and to the interpretation and use of satellite data in meteorology. The problems discussed in the articles offer new ways of approaching satellite meteorology and new perspectives for its development. Author

N69-15739# Oklahoma Univ., Norman. Dept. of Meteorology.
DEVELOPMENT OF SHORT RANGE FORECASTING TECHNIQUES Final Report
Victor S. Whitehead, William J. Parton, and Sam J. Hall Jun. 1968 114 p refs
(Contract Cwb-11372)
(PB-179722) Avail: CFSTI CSCL 04B

This study is concerned with the short term (18 hours or less) prediction of precipitation probability in the vicinity of Oklahoma City. The responsibility of such forecast rests eventually with the field forecaster, as it should. He has at his disposal many of the centrally produced tools, along with the most recent observation, and, hopefully, knowledge of the peculiarities of his locale. Unfortunately he is lacking in guidelines as to how best assimilate the tools at his disposal. This and similar studies should have this objective as a primary goal. Author (USGRDR)

N69-15800# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
A REVIEW. CLEAR AIR TURBULENCE DETECTION METHODS: REMOTE ATMOSPHERIC PROBING PROJECT
David Atlas 11 Jun. 1968 21 p refs Presented at the Symp. on Clear Air Turbulence and its Detection, Seattle, 15–16 Aug. 1968
(Grant NSF-GA-819)
(TN-1) Avail: Issuing Activity

Of the various methods proposed for CAT detection, only ground-based ultra-sensitive radars have demonstrated partial success. It can now be predicted with some assurance that a 20 db improvement in sensitivity of airborne radars will permit CAT detection at a range of about 10 n. mi., although not with 100% confidence. In particular, vertical wind shear in excess of 10^{-2} sec^{-1} appears to be a suitable criterion for its occurrence. The magnitude of the refractivity structure constant C_n^2, and thus the radar reflectivity, should be a useful CAT indicator in the upper

troposphere. Dual pulse lidar techniques (using aerosol scatter) for the measurement of differential air velocity in adjacent volumes ahead of the aircraft would become feasible for CAT detection with a 100-fold increase in both sensitivity and coherence of pulsed lasers. Author

N69-15811# Institut Royal Meteorologique de Belgique, Brussels.
THE WEATHER IN 1967 [LE TEMPS EN 1967]
R. Sneyers 1968 57 p refs In FRENCH /*ts* Publ. Ser. B, No. 53
Avail: CFSTI

A climatological commentary is presented for December 1966 through November 1967 for Belgium. The general atmospheric pressure, wind speed and direction, haze and sunshine, air temperature, humidity, and precipitation are tabulated, graphed, and compared to established norms. The main weather influences on the countryside are summarized for each month studied. Transl. by B.P.

N69-15864# Chicago Univ., Ill. Dept. of the Geophysical Sciences.
GROWTH, MOTION AND CONCENTRATION OF PRECIPITATION PARTICLES IN CONVECTIVE STORMS: REMOTE ATMOSPHERIC PROBING PROJECT
R. C. Srivastava and David Atlas 1 Nov. 1967 32 p refs
(Grant NSF-GA-919)
(TR-2) Avail: Issuing Activity

Analytical solutions for the growth and vertical and horizontal motion of a precipitation particle growing by coalescence with cloud drops are derived under simplified steady state assumptions. An equation is also developed for the concentration density of a continuous distribution of growing particles which removes the infinity which previous treatments showed to be present at heights where the particles attain fall speed equal to the updraft. It is shown that the combination of an increasing updraft surmounted by a sharply decreasing one sets a sharp upper limit to the particle size, and sorts the particles horizontally. Particles which spend their entire life in regions of horizontal convergence associated with increasing updraft are packed into a narrower shaft than that in which they originated. Initially smaller particles are carried above into the region of horizontal divergence associated with decreasing updraft and are displaced far to the sides of the cloud core. It is found that when the updraft increases sharply there is a very small range of initial sizes which can grow to fall-out size. These facts are used to suggest that a steady balance level (equal reflectivity in rising and falling particles) may be maintained at a height near and below an updraft maximum. Author

N69-15964# Chicago Univ., Ill. Dept. of Geophysical Sciences.
THE CONTROL OF SUMMERTIME CUMULI AND THUNDERSTORMS BY LAKE MICHIGAN DURING NON-LAKE BREEZE CONDITIONS
Walter A. Lyons and John W. Wilson (Ill. State Water Surv.) Jun. 1968 37 p refs Prepared in Cooperation with Mich. Univ., Ann Arbor and Ill. Univ., Chicago
(Contract AT(11-1)-1199) Grants Cwb-WBG-34; PHS-AP-00380-03; Proj. Mesometeorology)
(SMRP-RP-74; PB-179430) Avail: CFSTI CSCL 04B

The paper reports on a one day field study over Lake Michigan (26 July 1966), observing the response of convective nephsystems to the cold water surface during non-lake breeze conditions. As appears typical of these situations, large cumulus clouds dissipated after about 10 miles of over-water fetch with no cumulus reforming further out over the lake. Although all advected cumuli dissipated, a moderately intense squall line was able to cross the southern basin in the afternoon. Gain-stepped radar data indicate no decrease of echo strengths over water. Cloud photographs and surface data also established the existence of, (1) a band of shoreline convergence along the southeastern shore where the prevailing winds paralleled the coast, and (2) a 20-mile wide cumulus-free zone on the eastern shore, apparently marking a zone of subsidence and air-mass remodification. Author (USGRDR)

N69-15965# Chicago Univ., Ill. Dept. of Geophysical Sciences.
HEAVY SNOW IN THE CHICAGO AREA AS REVEALED BY SATELLITE PICTURES
James Bunting and Donna Lamb Jul. 1968 54 p refs
(Grant Cwb-WBG-34; Proj. Mesometeorology)
(SMRP-RP-75; PB-179431) Avail: CFSTI CSCL 04B

The Great Chicago Snowstorm of '67 left a deep and persistent snowbelt across Northern Illinois, Indiana, and Southern Michigan. The change of this snow cover with time is studied, first from the ground in the vicinity of Chicago and then from satellite pictures over a much larger area. The appearance of snow near Chicago is compared with the appearance of snow on other physiographic areas such as extensive forests and mountains. Techniques useful in distinguishing snow from clouds are discussed. Author (USGRDR)

N69-15966# Weather Bureau, Garden City, N. Y. Eastern Region Headquarters.
A STUDY OF THE AREAS OF MAXIMUM ECHO TOPS IN THE WASHINGTON D.C. AREA DURING THE SPRING AND FALL MONTHS
Marie D. Fellechner Apr. 1968 15 p refs
(WBTM-ER-27; PB-179339) Avail: CFSTI CSCL 04B

The close cooperation and frequent exchange of meteorological information between the Radar Meteorologists and Aviation Forecasters at Washington National Airport has led to the belief that particular geographical areas nearby favored the development of more intense thunderstorms during certain seasons of the year. Case studies that have been made of weather in connection with aircraft accidents and incidents involving severe turbulence have tended to support this hypothesis. Several occurrences of severe turbulence associated with thunderstorms over the Chesapeake Bay, during the late fall months, have been most prominently identified. To a lesser extent, turbulence to the lee of the mountains has been noted in connection with thunderstorms and thundersqualls in the spring and early summer. Author (USGRDR)

N69-15969# Weather Bureau, Silver Spring, Md. Equipment Development Lab.
A SELECTIVE PRECIPITATION INDICATOR
Richard C. Peck Jul. 1968 24 p refs
(WBTM-EDL-4; PB-179344) Avail: CFSTI CSCL 04B

The selective precipitation indicator is an electronic instrument of composite design to sense or detect the presence of dew, frost, drizzle, rain, or snow; to differentiate between these hydrometeor forms; and finally, to render a decisive report concerning their incidence, duration, and type. The instrument is described and its design, characteristics, and use are discussed in detail. Schematic and block diagram Δ are included. Author (USGRDR)

N69-15977# Environmental Science Services Administration, Washington, D. C. National Meteorological Center.
NUMERICAL WEATHER PREDICTION ACTIVITIES: FIRST HALF OF 1968
[1968] 35 p refs
Avail: Issuing Activity

Progress is reported in the numerical weather prediction activities at the National Meteorological Center. Revisions and corrections in data handling for weather forecasting are the main emphasis of this report. B.P.

N69-15978# Weather Bureau, Garden City, N. Y. Eastern Region Headquarters.
WASHINGTON METROPOLITAN AREA PRECIPITATION AND TEMPERATURE PATTERNS

N. L. Canfield and C. A. Woollum Jun. 1968 38 p refs
(WBTM-ER-28; PB-179340) Avail: CFSTI CSCL 04B

The purpose of the report is to present an updated selection of very generalized patterns of Washington, D. C. metropolitan area precipitation and temperature data as drawn by Woollum. Seasonal and annual maps are based on 20 years of record, 1946 through 1965. A few of the monthly maps and one of the daily maps are based on 1966 or 1967 events that exceeded extremes for the basic 20-year period. Author (USGRDR)

N69-15979# Weather Bureau, Garden City, N. Y. Eastern Region Headquarters

MONTHLY PRECIPITATION—AMOUNT PROBABILITIES FOR SELECTED STATIONS IN VIRGINIA

M. H. Bailey Jun. 1968 18 p refs
(WBTM-ER-30; PB-179342) Avail: CFSTI CSCL 04B

The report initiates application of an established statistical analysis producure in Virginia. Thirty years of monthly data from six well-dispersed stations provide a first survey of precipitation variability across the state. As circumstances permit, data will be analyzed for more stations and for critical intervals shorter and longer than one month. The results are applicable to a number of weather-affected activities requiring long-range planning, i.e. for periods beyond the life span of conventional weather forecasts. Where such activities in or for Virginia localities suggest computation for time intervals or risk levels other than those used here, the ESSA State Climatologist in Blacksburg, Virginia should be advised. Author (USGRDR)

N69-15980# Weather Bureau, Garden City, N. J. Eastern Regional Headquarters.

CLIMATOLOGICAL REGIME OF RAINFALL ASSOCIATED WITH HURRICANES AFTER LANDFALL

Robert W. Schoner Jun. 1968 29 p refs
(WBTM-ER-29; PB-179341) Avail: CFSTI CSCL 04B

The study gives (1) the climatology of arealaverage and maximum point rainfall depths for 24 hours after a hurricane's landfall, (2) the characteristic rainfall patterns for the duration of hurricanes as they neared then passed over a land mass, and (3) the unusual hurricane rainfall events of record, to provide valuable criteria, either for evaluating a region's hurricane flood potential, or for determining a hurricane precipitation forecast. Author (USGRDR)

N69-15982# Pennsylvania State Univ., University Park. Dept. of Meteorology.

LAKE-EFFECT STUDIES Final Report

L. G. Davis, R. L. Lavoie, J. I. Kelley, and C. L. Hosler May 1968 120 p refs
(Contract E22-80-67(N))
(PB-179730) Avail: CFSTI CSCL 04B

Observational studies involving instrumental aircraft, radars, and special ground networks have been conducted near Lake Erie in order to describe the 'lake-effect' storm. It has been found that the precipitation in these storms comes from relatively shallow clouds which form in bands generated by the mesoscale circulation. Aircraft penetrations and snow samples indicate a high degree of riming exists in these clouds. A numerical model has been developed to deal specifically with the type of environment generally associated with the lake-effect storm. Numerical experiments were conducted to demonstrate the individual effects of friction, heating, orography, and wind direction in shaping the mesoscale circulations. With the improved knowledge on the mechanisms involved in the lake-effect storms it is felt that consideration can now be given to modification techniques. Author (USGRDR)

N69-16083# Chicago Univ., Ill. Dept. of Geophysical Sciences.

A MESOMETEOROLOGICAL STUDY OF A SUBTROPICAL MESOCYCLONE

Hidetoshi Arakawa (Meteorol. Res. Inst., Tokyo), Kazuo Watanabe (Meteorol. Res. Inst., Tokyo), Kiyoshi Tsuchiya (Japan Meteorol. Agency), and Tetsuya Fujita May 1968 33 p refs
(Grants Cwb-E-86-67-(G); NSF GP-255)
(PB-179462; SMRP-RP-68) Avail: CFSTI CSCL 04B

In order to establish the classification of a mesoscale cyclone of September 1, 1960, which formed over tropical waters and moved over Japan the next day, the cyclone was located on a maximum windspeed vs. storm diameter diagram. The cyclone was classified as a subtropical mesocyclone because it was located on the border line between mesocyclones and tropical depressions. A three-dimensional analysis of the wind field was made by making use of the existing techniques of time-to-space conversions and of new methods of interpolation for construction of vertical space cross sections. Results showed that the subtropical mesocyclone was characterized by an overall mass inflow which was between a large thunderstorm and a mature hurricane. Author (USGRDR)

N69-16094# Sandia Corp., Albuquerque, N. Mex.

CLIMATOLOGY OF TONOPAH TEST RANGE, 1967

J. R. Schaeffer Sep. 1968 74 p
(Contract AT(29-1)-789)
(SC-M-68-522) Avail: CFSTI

The climatology of the Tonopah Test Range is described by: climatic summaries of temperature, relative humidity, station pressure, precipitation, and surface winds during 1967; summaries of the same elements based on 7-year averages covering the years 1961 to 1967; and summaries of upper winds based on the years 1961 to 1967. Author (NSA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-15083# Lear Siegler, Inc., Grand Rapids, Mich. Instrument Div.

LEAR SIEGLER, INC., MODEL 6340C TYPE AN/AYN-1 NAVIGATION COMPUTER TEST

H. Rossin 4 Jun. 1968 347 p
(Contract TCG-1300-A)
(AD-674640; GRR-6340-081) Avail: CFSTI CSCL 17/7

The report presents certified test data obtained during a preproduction test program conducted on (LSI) Model 6340c, Navigation computer set, in conformance with the requirements of LSI specification PD 1193, revision B, and contract no. TCG-13001-A. Author (TAB)

N69-15194 Auburn Univ., Ala.

A RADIO FREQUENCY DIRECTION FINDING SYSTEM EMPLOYING DIRECTION COSINES

Herbert Preston Neff, Jr. (Ph.D. Thesis) 1967 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-5895

A radio frequency direction finding system incorporating a minimum number of antenna elements is developed, and the theory governing its behavior is presented. This device has the unique feature of determining the direction of arrival of a radio frequency wave by two phase measurements. The phase angles measured are directly proportional to the direction cosines referred to the x and y axes, respectively, in the horizontal plane. A knowledge of these direction cosines uniquely determines the pointing of a radius vector from the coordinate system origin to the source of the radio frequency wave. Dissert. Abstr.

N69-15348*# Techtran Corp., Glen Burnie, Md.
CERTAIN UNIVERSAL SYSTEMS OF NAVIGATION VIA SATELLITES [QUELQUES SYSTEMES UNIVERSELS DE NAVIGATION PAR SATELLITES]
A. Dauguet Washington NASA Jan. 1969 16 p refs Transl. into ENGLISH from FRENCH Presented at the 19th Congr. of the Intern. Astronautical Federation, New York, 13–19 Oct. 1968
(Contract NASw-1695)
(NASA-TT-F-12092) Avail: CFSTI CSCL 17G

The feasibility of developing a universal system of navigation via satellites is explored. Three essential parameters of performance: precision in determining position, maximum time to obtain a position, and maximum duration of measurement, are considered. Classical principles of navigation: astronomical, radio-electric, and inertia or doppler, are outlined and their potential applications to navigation via satellites is discussed. Triangulation procedures, based on measurement of distances or differences in distances, can be used by satellites with circular or hyperbolic modes. Passive or active systems, in which the navigator can or cannot emit a signal, are possible. The advantages and disadvantages of four specific systems are considered: the passive TRANSIT Doppler satellite; the active DIOSCURES system with two stationary satellites in the circular mode; the R. C. A. SPOT system, which has an optional mode of operation; and a Westinghouse system of synchrones satellites, designed for passive use by an unlimited number of users.
Author

N69-15552# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.
AUTOMATIC NAVIGATION Scientific Interim Report, 1 Sep. 1967–1 Sep. 1968
Andrew P. Sage Sep. 1968 46 p refs
(Contract F44620-68-C-0023)
(AD-677304; AFOSR-68-2202) Avail: CFSTI CSCL 17/7

The report summarizes the activities in Automatic Navigation under Air Force Office of Scientific Research Contract F44620-68-C-0023 during the period 1 September 1967 through 1 September 1968. It is in the general field of control theory emphasizing estimation, including application to automatic navigation. Certain of the special interests are: non-stationary, non-linear, and sub-optimal aspects. Approaches include Kalman filter theory, graph theory, invariant imbedding, Pontryagin optimization, differential game theory, modern stability theory, distribution theory, etc.
Author (TAB)

N69-15779# Columbia Univ., Dobbs Ferry, N. Y. Hudson Labs.
OMEGA NAVIGATION PERFORMANCE OFF NORTHWEST AFRICA DURING OPERATION NO. 267, 23 APRIL–28 MAY 1968
A. Zuccaro and Peter A. Rona Aug. 1968 37 p refs
(Contract Nonr-266(84))
(AD-678443; CU-181-68-ONR-266-Phys; TR-153) Avail: CFSTI CSCL 17/7

A Tracor 599R Omega receiver was operated in the region between the Canary Islands and the Cape Verde Islands off northwest Africa almost continuously for five weeks during April and May 1968. The unit generally tracked consistently during daylight hours. Inconsistencies in tracking repeatedly appeared during certain nighttime hours. Positional inaccuracies up to about plus or minus 5 nautical miles were indicated by comparison of the Omega fixes with fixes obtained by other navigational methods.
Author (TAB)

N69-15783# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
SOME METHODS OF REFERENCE STAR ACQUISITION FOR THE L.A.S.
D. N. Soo Paris ESRO Jan. 1968 51 p
(ESRO-TM-P-127-ESTEC) Avail: CFSTI

This report is concerned with the problem of reference star acquisition during the Acquisition Phase of the Large Astronomical Satellite Control System. Three methods are discussed and analyzed. The performance of each system is measured by the time of acquisition from an initial displacement of the star sensor optical axis of 180° from the line of sight to the reference star. Two of the methods discussed depend upon the size of the star sensor field of view; the third method discussed is independent of the star sensor field of view and is shown to be the minimal time solution to the acquisition problem.
ESRO

N69-15828# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
PROBLEMS IN THE DESIGN OF A STAR-MAPPER SYSTEM
J. J. Weaver Paris ESRO Jun. 1968 62 p refs
(ESRO-TM-P-68(ESTEC)) Avail: CFSTI

Some of the major problems in the design of a star-mapper system are considered, with emphasis on those arising from the method of stellar magnitude discrimination which define the star patterns and a method of correlating the resulting data with known information. The experimental work on the detectors must be used as a basis of a final selection of the star to be chosen and the efficiency of the magnitude discrimination system will affect the extent of the logic system. The production of an optimum system will depend on a suitable choice of filters for the magnitude system chosen. the V system appears to fulfil the requirements.
Author (ESRO)

N69-15835# Joint Publications Research Service, Washington, D. C.
USSR ELECTRONIC LANDINGS, TAKEOFFS DESCRIBED
O. Buzuluk et al 31 Dec. 1968 5 p Transl. into ENGLISH from Tekhn., i Vooruzheniye (Moscow), no. 8, Aug. 1968 p 32–33
(JPRS-47164) Avail: CFSTI

Modern airport facilities in the U.S.S.R. are described which provide electronic controls for takeoff and landing, thereby decreasing the dependence of aviation on meteorological conditions.
A.C.R.

N69-15844# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
PHOTOELECTRON FLUCTUATION NOISE IN THE STATIC SPLIT SENSOR
R. Collette Paris ESRO Feb. 1965 43 p refs
(ESRO-TM-P-6-ESTEC) Avail: CFSTI

Starlight photometric data as well as photon detector characteristics are discussed in detail. Formulae are derived for the mean rate of generation of electrons and its mean square deviation. The signal-to-noise ratio is derived for the static split sensor and is also expressed in terms of angular noise. Numerical results, based on estimated values of the parameters involved, are obtained for the fine and coarse guidances aboard the astronomical satellite.
ESRO

N69-15854# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
STAR REFERENCE SYSTEM AND OCCULATION PROBLEMS
A. Bastos Paris ESRO Dec. 1964 55 p
(ESRO-TM-P-1(ESTEC)) Avail: CFSTI

The concept of a stable platform, using stars as space references, is discussed. The various factors involved in determining the number and location of suitable stars for several platform configurations are examined taking into consideration the effect of the earth and satellite main body shadows. A brief note on the number and power requirements of star sensors is also included. It is concluded that a satisfactory solution would be a main satellite body with two platforms diametrically opposite, each containing six star sensors and using a total of six reference stars.
ESRO

N69-15011# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
DETERMINATION OF THE POSITION OF AN ARTIFICIAL SATELLITE BY SIMULTANEOUS OBSERVATION OF ITS TOPOCENTRIC DIRECTIONS FROM KNOWN STATIONS ON THE EARTH'S SURFACE [OPREDELENIE POLOZHENIYA ISKUSSTVENNOGO SPUTNIKA PO SINKHRONNYM NABLYUDENIYAM TOPOTSENTRICHESKIKH NAPRAVLENII NA NEGO S IZVESTNYKH PUNKTOV NA POVERKHNOSTI ZEMLI]
I. D. Zhongolovich Oct. 1968 16 p refs Transl. into ENGLISH from Akad. Nauk SSSR, Inst. Teor. Astron. (Leningrad), v. 10, no. 8 (121), 1966 p 509-515
(AD-678357; ACIC-TC-1425) Avail: CFSTI CSCL 17/8

The paper deals with the case of simultaneous observations of a satellite from three known stations on the earths surface. The results may be easily generalized for the case of similar observations from more stations, as well as for that of observations from two stations only. Author (TAB)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-15035# Gulf General Atomic, San Diego, Calif.
LATTICE PHYSICS STUDIES Quarterly Progress Report, Period Ending Jun. 30, 1968
G. D. Trimble, T. Gozani, J. M. Neill, and C. A. Preskitt 22 Jul. 1968 64 p refs
(Contract AT(04-3)-167)
(GA-8805; EURAEC-2068) Avail: CFSTI

Thermal neutron spectra are measured at seven spatial positions across the central cell of a 1.0 in. triangular pitch U rod lattice. The measurements are performed at the Lattice Experiment Facility. The techniques used to measure neutron spectra in lattices are described. The program being developed to measure the thermal neutron spectrum in $Pu(NO_3)_4$ solutions is described. NSA

N69-15048# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SURVEY OF REACTOR NOISE TIME ANALYSIS METHODS
N. Pacilio Aug. 1968 45 p refs
(Contract AT(45-1)-1830)
(BNWL-875) Avail: CFSTI

Brief descriptions of techniques related to the reactor fluctuations in the time domain are presented. The techniques described include: methods based on time correlation analysis among the pulses; methods based on analysis of the moments of the distribution (n_i); methods based on differential analysis of the distribution (n_i); and methods based on correlation analysis among the signs of the fluctuations of n_i around its mean value. NSA

N69-15068 Ohio State Univ., Columbus.
A COINCIDENCE TECHNIQUE FOR THE NONDESTRUCTIVE MEASUREMENT OF THE NEUTRON CAPTURE RATE OF A U 236 FOIL IN A ZERO POWER FAST REACTOR
Ronald James Hall (Ph.D. Thesis) 1967 133 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8831

A purely physical technique for measuring the neutron capture rate of a ^{236}U foil in a zero power reactor was developed. Capture in ^{236}U was measured by observation of ^{237}U decay. The rate of ^{237}U decay was determined with an absolutely calibrated gamma-gamma coincidence system. Germanium detectors were used in the coincidence system. The ^{236}U neutron capture rate was measured with a standard error of less than 3%. The ratio of the number of captures by ^{236}U to the number of fissions of ^{235}U at the irradiation position was found to be 0.248 with a standard error of approximately 4%. Dissert. Abstr.

N69-15081# Mound Lab., Miamisburg, Ohio.
CRITICALITY ANALYSIS OF THE LARGE HEAT SOURCE SYSTEM CONTAINING PLUTONIUM 238 DIOXIDE FUEL
R. A. Wolfe 1 Oct. 1968 9 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1532) Avail: CFSTI

A criticality analysis was made of a $^{238}PuO_2$ radioisotope heat source system that will provide 25 kW of thermal power to a Brayton cycle power conversion system designed for space application. The calculations revealed a considerable degree of subcriticality for the Large Heat Source System. The only credible mechanism that could result in criticality of the ^{238}Pu-fueled Large Heat Source System would be a massive meltdown of the capsules and reassembly of approximately one-fourth of the fuel in some container such as a reentry body. The occurrence of criticality would not create significant additional radiological hazards beyond or different in magnitude than those posed by possible fuel dispersal. Author (NSA)

N69-15082# Los Alamos Scientific Lab., N. Mex.
ULTRA HIGH TEMPERATURE REACTOR EXPERIMENT (UHTREX) Quarterly Status Report, Period Ending Jul. 31, 1968
K. Division, comp. Sep. 1968 16 p ref
(Contract W-7405-ENG-36)
(LA-4009-MS) Avail: CFSTI

Experimental data are presented on the reactivity effects, measurements of effect of variation in coolant pressure and flow rate, temperature coefficient measurement, and startup procedures for the Los Alamos turret reactor. Also reported are data on measurements of absolute neutron fission rates in UHTREX, corrosion protection, testing of thin layer pyrocarbon, neutron fission energy profiles, thermal properties of coated particles, methods for position indication and calibration, effects of UHTREX coolant pressure and flow rate variations, the performance of UHTREX helium coolant flow control digital computer, and the performance of UHTREX stack and annuciator panel. NSA

N69-15119# Brookhaven National Lab., Upton, N. Y.
SIZE DEPENDENT EXTRAPOLATION DISTANCES FOR PULSED SMALL SYSTEMS
J. Dorning Feb. 1968 9 p refs Presented at 14th Ann. Meeting of Am. Nucl. Soc., Toronto, Jun. 1968 Supported in part by AEC
(BNL-12226; CONF-680601-36) Avail: CFSTI

Size-dependent extrapolation distances were calculated for small spherical light water systems using the pulsed-neutron experiment asymptotic decay constant as a consistency criterion between exact transport theory and asymptotic reactor theory. The method used related a real system dimension to an extrapolated system dimension through the fundamental-mode time decay constant. The decay constants used were taken from previous work in which they were calculated as a function of system size by the S_n method. NSA

N69-15128# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
GAS DISCHARGING ION SOURCE FOR THE ELECTROMAGNETIC MASS SEPARATOR ON-LINE WITH THE HEAVY ION CYCLOTRON
N. I. Tarantin, A. V. Dem'yanov, N. S. Ivanov, and A. P. Kabachenko 1968 23 p refs In RUSSIAN
(JINR-P13-4061) Avail: CFSTI

The gas discharging ion source is described which is used in the electromagnetic mass-separator on-line with the heavy ion cyclotron. This source is of the inverse-magnetron type, one of the peculiarities of which is, that the target, bombarded by the accelerated heavy ions, is located in the window of the discharging chamber so that the nuclear reaction products reach directly the ion source of the continuous mass-separator. The basic regularities of the charge in the ion source of this type are given. The efficiency of the separation, provided by this source on-line, is of 40 to 60% for Rn isotopes. Author (NSA)

N69-15130# International Atomic Energy Agency, Vienna (Austria).
POWER AND RESEARCH REACTORS IN MEMBER STATES
Jan. 1968 55 p
(NP-17648) Avail: CFSTI

The 20th periodic summary table of nuclear power reactors in operation, under construction, or planned in the member states of the IAEA is presented. Also included is a list of research reactors in operation or under construction. To illustrate the growth of installed capacities of power reactors and the number of research reactors, numerical tables and graphs are presented. A map giving the location of nuclear power plants in the IAEA member states is also presented. NSA

N69-15179# Atomics International, Canoga Park, Calif.
ATOMICS INTERNATIONAL REACTOR COMPUTATIONAL SYSTEM
R. A. Blaine 30 Aug. 1968 44 p refs
(Contract AT(04-3)-101)
(AI-AEC-Memo-12735) Avail: CFSTI

An open ended computational system for reactor design and analysis is described. The CAESAR, CLIO-II, EXPERT, AILMOE, and GRISM programs are presently incorporated into the system, and they can be run individually or in any combination. An iterative calculation of region dependent spectra is used to illustrate the capability of the system. NSA

N69-15181# Atomics International, Canoga Park, Calif.
AEC UNCLASSIFIED PROGRAMS Quarterly Technical Progress Report, Jan.–Mar. 1968
Mar. 1968 206 p refs
(Contract AT(04-3)-701)
(AI-AEC-12680) Avail: CFSTI

Technical research progress is reported on: neutron cross sections, fast reactors, liquid metal fast breeder reactor, sodium, critical assemblies, Monte Carlo method, reactor safety, fission products, aerosols, sodium reactor experiment, liquid metal cooled reactors, loops, heaters, helium, reactor fuels, plutonium carbides, tungsten, uranium carbides, Hallam power reactor, fused salts, metals, salts, organic compounds, alloys, radiation, solids, chromosomes, and flowmeters. NSA

N69-15196# Technische Hogeschool, Delft (Netherlands).
THE SURFACE CHEMISTRY OF CARBON. STUDIES ON THE USE OF CARBON AS AN ADSORBENT IN NUCLEAR REACTORS OF THE AQUEOUS SUSPENSION TYPE
Theo van der Plas (Ph.D. Thesis) Oct. 1968 279 p refs
(NP-17651) Avail: CFSTI

Nonvolatile fission products can be removed from the circulating fuel stream of an aqueous homogeneous suspension reactor by continuously supplying adsorbent to the fuel stream and separating the fuel from the suspension in water. Hydrophilic, oxygen-rich carbon blacks are proposed as the adsorbing material. The adsorption of europium (conc. 10^{-7} molar) on carbons was investigated and compared with the adsorption on quartz. Europium was strongly bound to the carbon. A functional group was performed on oxygen-containing groups on the carbons. All of the oxygen present can be accounted for, although a number of discrepancies between the results of several of the methods used cannot be resolved. The behaviour under reactor irradiation of suspensions of carbon in water and dilute solutions of sulfuric acid or potassium hydroxide was investigated. Hydrogen and carbon dioxide are produced and some oxygen is fixed on the carbons. Author (NSA)

N69-15206# Hahn-Meitner-Institut fur Kernforschung, Berlin (West Germany).
CHEMICAL ASPECTS OF REACTOR SAFETY (LITERATURE REVIEW) [CHEMISCHE ASPEKTE DER REAKTORSICHERHEIT (LITERAURUEBERSICHT)]
E. Hoinkis Aug. 1968 33 p refs In GERMAN
(HMI-B-76) Avail: CFSTI

A literature review of the chemical aspects of reactor safety is given. Release and absorption of noble fission gases are discussed; fission product release from coated particles and fuel and clad materials is considered. Release and absorption of fission product iodine is considered. Release and absorption of fission product iodine is described. Efforts in filtration of aerosols are summarized; metal-water reactions are discussed. The steam oxidation of graphite and coated particles is described; corrosion aspects of reactor safety are outlined. Chemical reactions involving fuel material are discussed; the chemical problems involved in working with sodium coolants are detailed. NSA

N69-15212# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Angewandte Reaktorphysik.
INVESTIGATION OF THE DEPENDENCE OF THE REACTIVITY OF A FAST GAS COOLED 500 LITER REACTOR ON THE GAS DENSITY IN SNEAK-3A
P. Engelmann, A. M. Reberain, and D. Wintzer May 1968 41 p refs In GERMAN
(KFK-776; EUR-3955-d) Avail: CFSTI

A series of steam-void- and flood-experiments was performed in the U fueled SNEAK assemblies 3A-1 and 3A-2, in order to study the dependence on H_2 concentration of the reactivity in the range of $N_H = 0$ to $N_H = 3.6 \times 10^{21}$ cm $^{-3}$. A comparison of experimental data was made with calculations using the 28 group SNEAK set, SNEAK-PMB set, and ABN set, respectively. All calculations tend to underpredict the reactivity changes; both SNEAK-PMB and SNEAK set give reasonable values in the range $N_H = 0$ to $N_H = 1.8 \times 10^{21}$ cm $^{-3}$ (working point); the maximum deviations are 5 and 15%, respectively. The flood reactivity is underestimated with these sets by 20 and 25%. The ABN set, however, underpredicts both void- and flood-reactivities by 30 to 35%. Author (NSA)

N69-15237# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RESULTS FROM USAEC PLUTONIUM UTILIZATION PROGRAMS CONDUCTED BY BATTELLE-NORTHWEST
F. G. Dawson, comp. 28 Aug. 1968 101 p refs Presented at the Intern. Atomic Energy Agency Panel on Plutonium Util., Vienna, 2–6 Sep. 1968
(Contract AT(45-1)-1830)
(BNWL-SA-2065; CONF-680924-1) Avail: CFSTI

A status report on the present technology of Pu is presented. Topics discussed include: Pu utilization; fuel characteristics of Pu; fuel fabrication; physics behavior; and Pu fueling in water reactors. NSA

N69-15239# Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
METHOD OF ELECTROHYDRODYNAMICAL COOLING OF EXOTHERMAL RODS
H. N. Rosu 1968 6 p refs
(IFA-FR-60) Avail: Issuing Activity

An aluminum plaque 80 by 15 by 1.5 mm was designed and is used to improve the efficiency of uranium rod cooling in the VVR-S reactor. The rod was subjected to a nonuniform electrostatic field which improved heat transfer between the rod and the cooling agent. This heat transfer process is known as thermal electroconvection, surface electroconvection or electrohydrodynamic cooling. NSA

N69-15243# Brookhaven National Lab., Upton, N. Y.
HIGH-TEMPERATURE LIQUID-METAL TECHNOLOGY REVIEW. A BIMONTHLY TECHNICAL PROGRESS REVIEW. VOLUME 6, NUMBER 3
Jun. 1968 139 p Sponsored by AEC
(BNL-50127(PR-33)) Avail: CFSTI

High-temperature liquid-metal technology applicable to the fast breeder reactor development and to the development of nuclear-Rankine power systems for space vehicles is reviewed. Materials development, corrosion and mass transfer, heat transfer, fluid dynamics, instrumentation, purification, component development, physical properties, thermodynamics, chemical analysis, and power systems are discussed. NSA

N69-15248# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Heisse Chemie.
METAL NITRATE DISTRIBUTION IN $Pu(NO_3)_4$ $UO_2(NO_3)_2$ HNO_3/TBP-DODECANE SYSTEM
G. Baumgaertel, W. Ochsenfeld, and H. Schmieder [1968] 22 p refs Transl. into ENGLISH from the German Report KFK-680 (EURFNR-499; EUR-3707.d) Avail: CFSTI

Experimental distribution data were determined for the extraction system $Pu(NO_3)_4$–$UO_2(NO_3)_2$–HNO_3/TBP-dodecane in a wide uranium and plutonium concentration range. With the help of this data the distribution coefficients of U(VI) and Pu(IV) in TBP-dodecane could be determined with good accuracy. The equations developed were also used in stage calculations for extraction columns for reprocessing fast-breeder fuels. Author (NSA)

N69-15251# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
DEVELOPMENT OF PRODUCTION TECHNOLOGY OF COMBUSTIBLE ELEMENTS IN URANIUM ALLOYS [SVILUPPO DELLA TECNICA DI FABBRICAZIONE DI ELEMENTI DI COMBUSTIBILE IN LEGHE DI URANIO]
C. Fizzotti and B. Dalmastri 1968 52 p In ITALIAN
(Contract EURATOM-009-62-6-RGZI)
(RT/MET(68)2) Avail: CFSTI

Procedures for fabricating nuclear fuel elements of the type in use are discussed. The two ternary bars, U–Mo–Nb and U–Mo–Zr, are studied. The elements are 29.34 mm in diameter and 911.8 mm in length, and are sheathed by a flashing of magnesium alloy. When inserted into the core the sheath is compressed into the fuel anchoring the element. Three aspects are considered: (1) fusion of the bars, (2) heat treatment of the sheath, and (3) assembly of the element. Transl. by F.O.S.

N69-15261# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PROTEUS: A COMPUTER CODE TO EXTEND THE BURNUP DATA FROM A POINT BURNUP CODE
E. A. Eschbach, D. E. Deonigi, and M. F. Kanninen Jun. 1968 88 p refs
(Contract AT(45-1)-1830)
(BNWL-850) Avail: CFSTI

A computer code named PROTEUS has been developed to modify and extend data produced by the reactor fuel burnup code ALTHAEA in its zero dimensional mode. PROTEUS simulates either batch or graded fueling, prepares a table of maximum-to-minimum ratios of fuel specific power at constant flux, and calculates analytical curve fits of isotopic concentrations versus burnup. Author (NSA)

N69-15262# Atomics International, Canoga Park, Calif.
PHASE RELATIONSHIP IN THE ($\alpha + \delta$) REGION OF THE Zr-H SYSTEM
K. E. Moore and M. M. Nakata 30 Sep. 1968 47 p refs
(Contract AT(04-3)-701)
(AI-AEC-12703) Avail: CFSTI

The $(\alpha+\delta) \rightleftharpoons \delta$ phase boundary of the Zr–H system has been defined on the basis of studies performed on zirconium hydrides containing 4 at. % U (SNAP fuel). The methods used include optical hot stage microscopy and room-temperature metallography, dilatometry, and x-ray diffraction. This boundary was found to exist between about 1.33 H/Zr at 1020°F and 1.60 H/Zr at 75°F. A metastable phase, γ' coexisting with α and δ phases, was found to transform to δ at about 580°F between 1.20 H/Zr and the $(\alpha+\delta) \rightleftharpoons \delta$ boundary (1.50 H/Zr). Author (NSA)

N69-15283# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
FLUX MAPPING BY SEMI-CONDUCTOR DETECTORS IN EDF 3 REACTOR [CARTES DE FLUX PAR DETECTEURS A SEMI CONDUCTEURS SUR LE REACTEUR EDF 3]
Andre Tarabella Jun. 1968 46 p refs In FRENCH
(CEA-R-3297) Avail: CFSTI

Semiconductor neutron detectors were used for extensive flux mapping in the graphite-gas EDF-3 reactor. The maps were used to evaluate the hypotheses developed to account for flux tilting in large reactors. Author (NSA)

N69-15295# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
INTERIM SUMMARY OF WORK APPLICABLE TO ECC ON PHYSICO-CHEMICAL STUDIES OF CLAD UO_2 UNDER REACTOR ACCIDENT CONDITIONS
J. F. White Jun. 1968 41 p refs
(Contract AT(40-1)-2847)
(GEMP-619) Avail: CFSTI

Physico-chemical studies of clad UO_2 under reactor accident conditions are described, and studies on the behavior of Zircaloy- and 304 L SS-clad UO_2 fuel elements in steam and steam plus air above 1000°C are discussed. These studies are directed to the behavior of these fuel elements and associated reactor core materials under a loss-of-coolant core meltdown incident. Experimental work emphasized studies on the kinetics of oxidation of UO_2 to 1830°C; studies of the steam and air oxidation kinetics of Zircaloy-4 to 1800°C; studies of the steam and air oxidation kinetics of 304 L SS to 1375°C; studies to determine the effect of internal pressure on the behavior of Zircaloy-4 cladding as a function of heating rate; tests to determine the effect of oxidation on the deformation and failure of pressurized Zircaloy-4 tubing; measurements of spectral and total hemispherical emittance of unoxidized and oxygen saturated Zircaloy-4 and of oxide films on Zircaloy-4; construction of a test assembly for pressure testing of irradiated Zircaloy tubing at various heating rates in the 10 to 90°C/sec range, and completed preparation of $UO_{2.003 \pm 0.003}$ samples of 98% theoretical density for thermal conductivity measurements at various laboratories. Author (NSA)

N69-15320# Eidgenossische Technische Hochschule, Zurich (Switzerland).
CALCULATION OF HETEROGENEOUS RESONANCE INTEGRALS WITH CONSIDERATION OF A NON-ASYMPTOTIC MODERATOR FLUX AND A NON-UNIFORM TEMPERATURE DISTRIBUTION IN FISSION PRODUCTS [ZUR BERECHNUNG VON HETEROGENEN RESONANZINTEGRALEN UNTER BERUECKSICHTIGUNG EINES NICHTASYMPTOTISCHEN MODERATORFLUSSES UND EINER NICHT-UNIFORMEN TEMPERATURVERTEILUNG IM SPALTSTOFF]
Hugo Tschirky (Ph.D. Thesis) 1968 76 p refs In GERMAN /ts Dissertation No. 4133
Avail: CFSTI

Lie series and Monte Carlo calculations are utilized to find a numerical solution for a P_N – approximation of the integral-differential transport equation describing neutron resonance absorption in nuclear reactors. Considered are asymptomatic reactor flux as well as localized fission product temperatures in order to determine optimal constant fuel temperatures. Transl. by G.G.

N69-15325# Oak Ridge National Lab., Tenn.
BUILD-UP FACTORS FOR GAMMA-RAY PENETRATION THROUGH MULTIPLE LAYERS OF REACTOR SHIELDING
Mitsuyuki Kitazume and Akira Ogushi [1968] 26 p refs Transl. into ENGLISH of Hitachi Hyoron (Japan), v. 49, no. 7, 1967 p 1–8
(ORNL-TR-1906) Avail: CFSTI

Multiple layer transmission experiments were performed using a plane 10-Ci ^{60}Co source to give a monodirectional beam to study means of calculating the dose buildup factors necessary for gamma-shield design. The shielding materials studied were water, steel, and lead arranged in combination to build up as much as four layers of shielding. The experimental monolayer buildup factor came within a few per cent of coinciding with that obtained from the Kitazume equation for the case of a light-heavy two-layer system. The Broder equation gave results of a few per cent to 20% smaller for the heavy-light two-layer case. The combination of the Broder and Kitazume equations gave results which were 5 to 15% smaller. The results of this investigation indicate that the calculation of multilayer buildup factors to be used in shielding design is best achieved by combining the Broder and Kitazume equations, and the results should be valid within 15%. Author (NSA)

N69-15333# Idaho Nuclear Corp., Idaho Falls. National Reactor Testing Station.
ISOTHERMAL HYDRAULIC MEASUREMENTS IN FUEL ELEMENTS IN ATR CORE
M. L. Griebenow Sep. 1968 171 p refs
(Contract AT(10-1)-1230)
(IN-1158) Avail: CFSTI

Descriptions of the ATR core and fuel element configurations are presented. The results from isothermal hydraulics tests of the ATR fuel assemblies are discussed. The fuel assemblies were instrumented to measure the coolant flow rate and both axial and lateral pressure gradients within the reactor. NSA

N69-15335# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
STATUS OF THORIUM FUEL TECHNOLOGY
R. D. Leggett, ed. and R. S. Kemper, ed. Aug. 1968 180 p refs
(Contract AT(45-1)-1830)
(BNWL-861) Avail: CFSTI

Available information on the irradiation behavior of Th and Th alloys is analyzed. The physical and mechanical properties of Th are presented. The physical and mechanical properties are also listed for ThC, ThO_2, ThN, Pu–Th, Th–U, and Th–Zr. The corrosion properties of Th and Th alloys in water are presented. Fabrication processes for reactor grade Th are described. Fuel element fabrication of Th is described. Radiation effects on Th, and Th–U are analyzed. Dimensional stability and mechanical properties are examined. Performance of an irradiated Th–U–Zr fuel element is described. NSA

N69-15340# Oak Ridge National Lab., Tenn.
DEVELOPMENT AND FABRICATION OF INSTRUMENTED-PLATE ADVANCED TEST REACTOR FUEL ELEMENTS
J. H. Erwin, W. J. Werner, and M. M. Martin Oct. 1968 103 p
(Contract W-7405-ENG-26)
(ORNL-4268) Avail: CFSTI

A procedure was developed for manufacturing instrumented advanced test reactor fuel elements. The full-size assemblies are unique in that they contain one or two double-core fuel plates, which eliminate the intervening water channel to provide thermocouple wells for in-reactor temperature measurements. The two cores are replicas of the replaced standard core fabricated into a single 0.178-in.-thick plate to provide internal temperature measurement at 5 to 16 separate locations. Deviations from normal ATR fuel-element processing comprise solid-state reaction to prepare stoichiometric UAl_3, roll bonding of dual-cored plates, and malforming in compression. During fabrication development, noteworthy differences in the fabricability of U_3O_8- and UAl_3-bearing plates of equivalent U loading and geometry were observed. When compared to U_3O_8, the UAl_3-Al dispersion showed excessive growth during vacuum anneals, severe thickening or dog-boning near the core ends, and separation of tandem cores in rolling. Author (NSA)

N69-15343# Battelle Memorial Inst., Columbus, Ohio.
CIVILIAN APPLICATIONS Annual Progress Report, Jul. 1967-Jun. 1968
Donald L. Keller 1 Jul. 1968 69 p refs
(Contract W-7405-eng-92)
(BMI-1845) Avail: CFSTI

Papers on the characterization, development, and preparation of plutonium nitride fuels and ceramic-coated particle fuels and radiation effects on fast reactor cladding and structural materials for LMFBR applications are presented. NSA

N69-15392# Los Alamos Scientific Lab., N. Mex.
NEUTRON RESPONSE ANALYSIS IN PULSED COUPLED-CORE REACTORS
George C. Hopkins Nov. 1967 8 p refs
(Contract W-7405-eng-36)
(LA-3982) Avail: CFSTI

In the Los Alamos Coupled Reactor Experiment, some oscillatory deviations from the expected monotonic increase were observed in the rising portion of the passive core neutron density response. A generalized multigroup point kinetics model is employed to analyze the experiment. Several approximations with respect to the number of energy groups, the existence of a reflector, and the between-core neutron distribution function were studied. For some approximations, anomalies similar to those experimentally noticed were observed in the passive core response. Author (NSA)

N69-15409# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
THERMAL NEUTRON FLUX DISTRIBUTION FROM A Cf-252 SPONTANEOUS-FISSION NEUTRON SOURCE
D. W. Magnuson 17 Oct. 1968 22 p refs
(Contract W-7405-eng-26)
(Y-DR-1) Avail: CFSTI

Measurements were made of the spatial distribution of the thermal neutron flux near a ^{252}Cf spontaneous-fission neutron source in water. A maximum value of 0.0132 thermal neutrons/cm^2 per source neutron was found near the source and the distribution

was in excellent agreement with fluxes previously calculated using the ANISN code. The californium was dispersed in aluminum and sealed in an aluminum cylinder, 0.364 in o.d. and 0.75 in. long. The source strength was determined to be $7.32 \pm 0.36 \times 10^8$ neutrons/sec. Author (NSA)

N69-15410# Centre d'Etude de l'Energie Nucleaire, Brussels (Belgium).

[NUCLEAR RESEARCH] Annual Scientific Report, 1967

R. Billiau, ed., L. Buyse, ed., and H. Fredrix, ed. [1968] 41 p refs

(D/55/68; NP-17579) Avail: CFSTI

Separate abstracts were prepared for twelve sections of this report. Progress is reported on various aspects of technological research on reactors, production of radioisotopes, basic research on physics and radiobiology, chemical and radioactive analyses, and waste processing. A list of 344 publications is included. NSA

N69-15411# Atomic Energy of Canada, Ltd., Sheridan Park (Ontario).

DOUGLAS POINT HWR STARTUP PHYSICS MEASUREMENTS AND PREDICTIONS

A. A. Pasanen and J. F. Blansche Oct. 1967 78 p ref. Presented at the 14th Ann. Meeting of the Am. Nucl. Soc., Toronto, 10–13 Jun. 1968

(AECL-2712; CONF-680601-32) Avail: CFSTI; Issuing Activity $2.00

The measurements made during Phase B (zero power) commissioning of the Douglas Point heavy water power reactor, which provide useful reactor physics data, are described in detail. The calculations that were done prior to startup are described, and the measured results are compared with predictions. Possible reasons for discrepancies between predictions and measurement are discussed. Author (NSA)

N69-15414# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE STRUCTURAL DIAGRAM OF UC-W AND DIFFUSION OF U FROM UC INTO W

A. I. Yevstyukhin et al 3 Jan. 1968 10 p refs Transl. into ENGLISH from Inzh.-Fiz. Inst. Met. i Metalloved. Chistykh Metal. (Moscow), no. 5, 1966 p 99–104

(AD-678432; FTD-HT-23-1164-67) Avail: CFSTI CSCL 18/10

The structural diagram of the UC-W system was constructed. This diagram is of the eutectic type with a limited solubility in the solid state. The melting temperature of the eutectic is 2180 plus or minus 20C. The eutectic point corresponds to 10 wt. % W. The solubility of W at the eutectic melting point is about 8 wt. %. The solubility of W at 2000C is about 4 wt. %. The solubility of UC in W was not observed. The diffusion of U from UC into W was studied in the temperature interval of 1500-2100C. In the investigated temperature interval there is no reaction between UC and W. Author (TAB)

N69-15424# Thermo Electron Corp., Waltham, Mass.

RESEARCH AND DEVELOPMENT OF VACUUM FOIL-TYPE INSULATION FOR RADIOISOTOPE POWER SYSTEMS Quarterly Progress Report, Jun.–Aug. 1968

J. Carvalho, J. B. Dunlay, J. Fronduto, M. L. Paquin, and V. L. Poirier 8 Oct. 1968 64 p

(Contract AT(30-1)-3634)

(ALO-3634-10; TE-4058-46-68) Avail: CFSTI

Progress is reported on the development of high-temperature thermal insulation for radioisotope power systems. The zero-time performance measurements of the short-term life test samples have been completed and the 1000-hour soak period is now underway. A change in the appearance of tungsten foil exposed to high temperature was noted and a series of tests conducted to establish the cause of the change. The tests designed to optimize the layer spacing in cylindrical samples have been completed and the minimum thermal conductivities were associated with the most tightly wrapped samples. By contrast, however, the minimum heat fluxes through a given number of layers were associated with layer spacings of 4.6 mils/layer. The performance of Cu–ZrO_2, Al–ZrO_2, Ni–ZrO_2, and SS–ZrO_2 insulations have been evaluated at temperatures between approximately 200 and 700°C. Thermal conductivities on the order of 10^{-6} watts/cm°C were measured. Author (NSA)

N69-15445# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

REVIEW OF PARTICLE TRANSPORT IN A CONDENSING STEAM ENVIRONMENT

T. W. Horst 24 Jun. 1968 45 p refs

(Contract AT(45-1)-1830)

(BNWL-848) Avail: CFSTI

Aerosol transport and deposition in an environment consisting of a mixture of air and saturated steam adjacent to a heat transfer surface on which condensation is occurring is discussed. Basic information is drawn together regarding those phenomena which are unique to a condensing steam environment or are altered by the presence of condensing steam, with the view of prediction of particle transport from first principles. These phenomena include condensation in the presence of an inert gas, diffusiophoresis, thermophoresis, particle nucleation and growth, and Brownian and turbulent diffusion. Judgment is made of the probable relative importance of these various mechanisms for aerosol demobilization following a loss-of-coolant accident in a water cooled reactor. This compilation of background material is the base for an experimental and theoretical study to extend knowledge of particle transport in a condensing steam environment. Author (NSA)

N69-15447# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

RADIATION INDUCED CURRENTS IN CABLES

Ronald R. Bourassa, James L. Stringer, and Gary J. Dau 7 Feb. 1968 5 p ref. Presented at 14th Ann. Meeting of the Am. Nucl. Soc., Toronto

(Contract AT(45-1)-1830)

(BNWL-SA-1658; CONF-680601-38) Avail: CFSTI

The problem of currents induced in a coaxial cable was studied. An equation is given for the currents from gamma-ray absorption by photoelectric and Compton processes. Experiments were carried out in a ^{60}Co gamma source and a TRIGA reactor. The current was negative and proportional to the dose rate in the gamma source, while both negative and positive currents were induced in the reactor. The bulk conductivity of the MgO insulator was also measured. NSA

N69-15450# Bettis Atomic Power Lab., Pittsburgh, Pa.

INELASTIC BOWING OF MULTISPAN FUEL RODS SUBJECTED TO AXIAL THRUST AND TEMPERATURE GRADIENTS

J. B. Newman Sep. 1968 102 p refs

(Contract AT(11-1)-GEN-14)

(WAPD-TM-770) Avail: CFSTI

Bowing of multispan rod-type fuel elements depends upon heat-generation gradients, variations in heat transfer processes, and axial thrust. The fundamental aspects of the analysis of axially compressed multispan inelastic beams are presented. Flexibility of supports in both axial and transverse directions is considered and the method is applicable to problems in which the thrust depends upon the transverse deflection as well as problems involving prescribed axial thrust. The formulas presented here constitute the theory for a computer program of broad applicability in the transient analysis of fuel rod bowing. Author (NSA)

N69-15458# Atomic Energy Establishment, Winfrith (England). Technical Assessments and Services Div.
GMS 3: A USERS MANUAL FOR IMPROVED GENERALISED MULTIGROUP SCHEME USING WDSN Mk2 FOR THE KDF9 COMPUTER
M. R. Barnett and J. A. Ward Aug. 1968 54 p refs
(AEEW-M-825) Avail: CFSTI/HMSO 5s

GMS 3 is an extension, written for the KDF9 computer, of the reactor physics program GMS 1. An improved DSN routine has been incorporated, with consequent reduction in running time in many instances. Three alternative nuclear data libraries are now available, the latest of these being entirely consistent with that of WIMS. A treatment of neutron streaming in simple voids is incorporated in the routine which prepared few-group macroscopic parameters. Details of theory and programming are included. Author (NSA)

N69-15459# Los Alamos Scientific Lab., N. Mex.
A NUMERICAL STUDY OF EXCURSIONS IN UHTREX LOADED WITH URANIUM-THORIUM FUEL ELEMENTS
George C. Hopkins May 1968 6 p refs
(Contract W-7405-eng-36)
(LA-3959) Avail: CFSTI

A uranium-thorium loading has been proposed for the Ultra High Temperature Reactor Experiment (UHTREX). Calculations have been made for this loading for excursions resulting from step reactivity inputs of 20 cents to $2.00. The presence of thorium retards the transient significantly. Author (NSA)

N69-15463# Bettis Atomic Power Lab., Pittsburgh, Pa.
CALORIMETRIC RADIATION HEATING RATE MEASUREMENTS IN A CRITICAL ASSEMBLY AND COMPARISON TO DIFFUSION THEORY CALCULATIONS
L. A. Mikoleit, J. C. Braun, R. F. Beyer, T. M. Ryan, and R. F. Valentine May 1968 14 p refs Presented at the 14th Ann. Meeting of the Am. Nucl. Soc., Toronto, Jun. 1968
(Contract AT(11-1)-GEN-14)
(WARD-T-2111; CONF-680601-43) Avail: CFSTI

Calorimetric radiation heating rates were measured with various non-fuel materials in a very low power critical assembly. Detailed neutron and gamma ray distributions throughout the assembly and the absolute power level were also determined, thus providing a comprehensive set of data to test design models for calculating in-core radiation heating rates. One set of detailed diffusion theory calculations was completed and the results compared with experiment. Described are the calorimetric measurements, the diffusion theory calculations, and the comparison of the two. Author (NSA)

N69-15466# Sandia Corp., Albuquerque, N. Mex.
ANNULAR CORE PULSE REACTOR (ACPR) TRANSIENT HEAT TRANSFER MEASUREMENTS
J. B. Rivard Sep. 1968 29 p refs
(Contract AT(29-1)-789)
(SC-DR-68-625) Avail: CFSTI

The transient heat transfer characteristics of the Annular Core Pulse Reactor (ACPR) are an important consideration in high temperature pulsing operation. Measurements and analysis of these characteristics at the 900°C peak-fuel-temperature level are presented. An adequate DNB margin for operation at 1000°C peak fuel temperature is reported, and the erroneous indications of cladding thermocouples are discussed. Author (NSA)

N69-15469# Oak Ridge National Lab., Tenn.
ELECTRODISINTEGRATION OF ALUMINUM, IRON, NICKEL, AND COPPER AT 13.3 AND 16.0 GeV
Ernest L. Callis (Tenn. Univ., Knoxville) Sep. 1968 60 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2309) Avail: CFSTI

Absolute cross sections were measured for the production of several radionuclides by 13.3-GeV electrodisintegration of aluminum, iron, nickel, and copper. Relative yields of radionuclides produced by 16.0-GeV electrodisintegration of aluminum and iron were also measured. Foil samples of target materials were bombarded in electron beams at the Stanford Linear Accelerator. Gamma spectra of the residual radioactivity were measured with Ge(Li) spectrometers. Nuclides were identified by gamma energy and half-life. Yields of nuclides of a given element were observed to peak near the stable valley. The yields exhibit a pattern that indicates cascade-evaporation reactions are important. Unusually large yields of ^{32}P and ^{24}Na in iron targets and ^{15}O and ^{11}C in aluminum targets were observed; these are consistent with fission of the target nuclei. Author (NSA)

N69-15477# Oak Ridge National Lab., Tenn.
CHEMICAL FEASIBILITY OF FUELING MOLTEN SALT REACTORS WITH Pu F-3
R. E. Thoma Oct. 1968 37 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2256) Avail: CFSTI

The feasibility of starting molten salt reactors with PuF_3 is evaluated with respect to chemical compatibility within fuel systems and to removal of Pu from the fuel by chemical reprocessing after ^{239}Pu burnout. Compatibility within reactor containment systems is moderately well-assured but requires confirmation of PuF_3 solubility and oxide tolerance before tests can be made using the MSRE. Although separation of Pu and Pa in the chemical reprocessing plant, as would be desirable in a large breeder reactor, has not yet been demonstrated, conceptual designs of processes for effecting such separations are available for development. Author (NSA)

N69-15486# Oak Ridge National Lab., Tenn.
MEASUREMENT OF HELIUM VOID FRACTION IN THE MSRE FUEL SALT USING NEUTRON-NOISE ANALYSIS
D. N. Fry, R. C. Kryter, and J. C. Robinson 27 Aug. 1968 32 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2315) Avail: CFSTI

Investigations were made at the MSRE to determine if the amount of helium gas in the fuel salt could be measured using neutron noise analysis. The neutron power spectral density (NPSD) was measured at different reactor operating conditions and compared with analytical model predictions of the NPSD for the same conditions. The results of experimental tests and analytical studies have shown that the principal source of small neutron density fluctuation observed in the MSRE is He bubbles circulating in the fuel salt. The NPSD was most sensitive to changes in fuel temperature. The measurements showed that NPSD in the frequency range from 0.5 to 2 cps varies as the square of He void fraction as predicted by the model, and that the minimum void fraction is more nearly zero than the previously accepted value of 0.1%. It is concluded that changes in the circulating void fraction can be inferred with good sensitivity directly from neutron noise measurements, and, consequently, NPSD can complement and enhance the value of the MSRE reactivity balance calculations. Author (NSA)

N69-15487# Oak Ridge National Lab., Tenn.
PARTIAL INVESTIGATION OF FUEL CHANNEL SPACERS FOR AN HFIR-TYPE FUEL ELEMENT
R. D. Cheverton and W. H. Kelley 13 Aug. 1968 25 p refs
(Contract W-7405-eng-26)
(ORNL-TM-2332) Avail: CFSTI

A partial investigation has been conducted in connection with the use of coolant channel spacers in an HFIR-type fuel element. Heat transfer studies indicate that Al wire-type, opposed spacers will reduce the burnout heat flux by only 6%. Fabrication development indicates that the wire spacers could be either welded

to the plates with an ultrasonic welding technique, or they could be drawn into the channels of an otherwise assembled element and welded at the ends only. Flow tests on both types, using a 9-plate-segment test element, resulted in no fretting corrosion or other deleterious mechanical effects. Author (NSA)

N69-15492# Bettis Atomic Power Lab., Pittsburgh, Pa.
MEASUREMENTS OF NEUTRON FLUCTUATIONS, ABSOLUTE DETECTOR EFFICIENCY, AND NATURAL NEUTRON SOURCE STRENGTH IN A LATTICE OF SLIGHTLY ENRICHED UO_2 RODS IN LIGHT WATER. LSBR/LWBR DEVELOPMENT PROGRAM
D. R. Harris Jun. 1968 28 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-804) Avail: CFSTI

Measurements of neutron fluctuations have been made on a lattice of slightly enriched UO_2 fuel rods in light water. A ^{99}Mo activation measurement provided the absolute efficiencies of the three neutron counting channels employed. Fluctuations are found to be substantially larger than predicted by a simple model ignoring spatial effects and delayed neutrons. Large reactivity changes were monitored by changes in degree of fluctuations. The effects of large counting losses on the measured dispersion parameter, Y, were determined. The natural neutron source strength in the reactor was measured to be 1.53 ± 0.15 neutrons per second per kgm of U. Author (NSA)

N69-15495# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
TIME BEHAVIOUR OF THERMAL NEUTRONS IN MODERATING MEDIA [ZACHOWANIE SIE W CZASIE NEUTRONOW TERMICZNYCH W OSRODKACH MODERUJACYCH]
M. Borysiewicz and J. Mika 1968 27 p refs
(INR-P-925) Avail: CFSTI

The properties of neutron scattering kernels in various moderators which influence the eigenvalue spectrum of the operator appearing in the Boltzmann equation describing the time behavior of thermal neutrons are investigated. It is shown that the corresponding scattering operators are compact in all cases except for the elastic scattering in solids, which leads to a bounded operator. These effects allow description of the structure of the spectrum of the Boltzmann operator and permit proof of the existence and uniqueness of the solution of the initial value problem. Author (NSA)

N69-15510# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
SIMPL-1: SIMULATION IMPLEMENTING MACHINE PROGRAMMING LANGUAGE, VERSION 1
R. D. Benham, ed. Oct. 1968 87 p refs
(Contract AT(45-1)-1830)
(BNWL-878) Avail: CFSTI

SIMPL-1 is a hybrid operating software system for a fixed point PDP-7 digital computer and a Beckman 2133 analog computer. The programming method associated with SIMPL-1 belongs to the same family of continuous simulation language as MIDAS and PACTOLUS. The method is a dialect of the Digital Equipment Corporation's PDP-7 assembly language. When used on our most sophisticated nuclear plant simulation the hybrid processes information about 400 times faster than more conventional programming methods employing a UNIVAC 1108 digital computer equipped with floating point hardware. When SIMPL-1 programming methods are used without including the analog computer as part of the system, the effective speed of the system is decreased. However, the SIMPL-1 programming method increases the effective computing speed by factors up to 1000 as compared to software floating point FORTRAN. The computing frame time for this simulation is approximately 20 msec, which corresponds to processing speeds 10 times faster than real time. Author (NSA)

N69-15522# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
TABLES OF FORMULAE FOR CALCULATING THE MECHANICS OF STACK IN GAS-GRAPHITE REACTORS [FORMULAIRE POUR LE CALCUL DE LA MECANIQUE DES EMPILEMENTS DES REACTEURS GRAPHITE-GAZ]
Aug. 1968 192 p refs In FRENCH
(CEA-R-3518) Avail: CFSTI

Formulae are presented for the mechanical effects due to strains, thermal or otherwise, on graphite moderator blocks surrounded or supported by steel structures. Equations were established from experiments made with large pile models at CHINON. The formulae can be used to calculate displacement strain, and stress in EDF-type stacks with a horizontal triangular block lattice. Author (NSA)

N69-15540# Douglas United Nuclear, Inc., Richland, Wash.
CALCULATIONS OF PHYSICS PARAMETERS FOR MIXED FUEL-TARGET LATTICES
L. J. Agee 1 Feb. 1968 7 p refs Presented at 14th Ann. Meeting of Am. Nucl. Soc., Toronto, 9–13 Jun. 1968 Submitted for publication
(Contract AT(45-1)-1857)
(DUN-SA-55; CONF-680601-41) Avail: CFSTI

The ability to predict consistently the behavior of a wide variety of fuel-target mixed lattices using different combinations of computer codes is studied. Four representative sets of lattice physics parameter measurements in the Physical Constants Test Reactor are presented. Three different methods of combining the HAMMER and EXTERMINATOR-2 computer codes are compared. NSA

N69-15542# Battelle-Northwest, Richland, Wash. Reactor Neutronics Section.
OPERATION OF REACTOR SYSTEMS WITH A DIGITAL COMPUTER
R. G. Clark 31 Jul. 1968 12 p Presented at the Spring Meeting of the Am. Nucl. Soc., Toronto, 9–13 Jun. 1968
(Contract AT(45-1)-1830)
(BNWL-SA-1694-Rev; CONF-680601-42) Avail: CFSTI

A description of the High Temperature Lattice Test Reactor digital computer control system is presented. The system is referred to as the Programmed Measurement and Control System; and it consists of a control console, a PDP-7 digital computer, and an input–output interface section. Operational experience with the system is described. NSA

N69-15543# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PHOENIX FUEL EVALUATION IN A MARITIME REACTOR DESIGN
K. R. Wise and U. P. Jenquin Oct. 1968 38 p refs
(Contract AT(45-1)-1830)
(BNWL-851) Avail: CFSTI

The Consolidated Nuclear Steam Generator-II reactor concept was used as a reference design to compare fuel cycle costs for Pu fueled cores with a high ^{240}Pu content (Phoenix fuel) to costs for an enriched U base case core. The Phoenix fuel was found to be competitive with the slightly enriched U reference fuel. Results are presented in graphical and tabular form, and the results and calculational methods are discussed. NSA

N69-15574# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
SODIUM PURIFICATION IN RAPSODIE [LA PURIFICATION DU SODIUM]
Bernard Giraud Feb. 1968 65 p refs In FRENCH
(CEA-R-3395) Avail: CFSTI

General features of the fast reactor RAPSODIE are described, and properties of the liquid Na coolant are reviewed. General

principles of Na purification and impurity measurement are presented. The RAPSODIE Na purification system is described in detail and data obtained from operation during the first year are presented. NSA

N69-15609 Texas A&M Univ., College Station.
STUDIES OF FLOW REDISTRIBUTION OF EXTERNAL PARALLEL COOLANT OR MODERATOR FLOW THROUGH TUBE BUNDLES
Jorge A. Justiniano-Bayron (Ph.D. Thesis) 1967 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-5005

The problem of transverse flow redistribution for geometries of interest to nuclear reactor technology are investigated from a macroscopic point of view by studying methods of solving the pertinent equations, their finite difference representation, convergence criteria, the choice of boundary conditions and the selection of the control volume within the matrix of fuel rods. The arrays selected consist of a fixed number of fuel rods surrounded by the coolant or moderator inside a square, rectangular, or cylindrical structural member. The driving function is the set of initial mass velocities which are assumed to be constant and known at the flow channel entrances. Because the number of degrees of freedom for the flow redistribution in these geometries exceeds the number of flow equations, special techniques have been used to achieve convergence of not only the axial pressure drop, but which will also yield a symmetrical flow redistribution when symmetrical problems are solved. Dissert. Abstr.

N69-15636# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
REMARKS ON ARRAY CRITICALITY TECHNIQUES
J. T. Thomas 20 Sep. 1968 23 p refs
(Contract W-7405-ENG-26)
(Y-DR-2) Avail: CFSTI

The problem of establishing the critical parameters for an array of arbitrary units of fissile materials is analyzed. The techniques described characterize a mass of fissile material by its multiplication factor. A critical assembly of N units of spherical masses in cubic cells is determined by adjusting the spacing of the units such that the correct interchange of leakage neutrons will occur between units and the correct fraction lost from the array. Two critical arrays of differing numbers, N, for a given unit establish the fraction of neutrons that must be lost from the arrays or the total fraction of neutrons that must remain in the array to maintain criticality. The NB^2 method may then be employed to specify criticality at other N values and therefore complete the characterization of critical arrays for the unit. Examples are presented. 7 references. Author (NSA)

N69-15654# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Development Center.
POSTIRRADIATION EXAMINATION OF THORIA-URANIA FUEL RODS Quarterly Progress Report, Mar.-May 1968
W. N. Bishop, C. J. Baroch et al Jul. 1968 23 p refs
(Contract AT(30-1)-3809)
(BAW-3809-4; QPR-4) Avail: CFSTI

Isotopic and metallurgical analyses on ThO_2-UO_2 fuel, stainless steel cladding, and Zircaloy fuel can form Core A of Indian Point Power Reactor, Unit 1 are described. Profilometer measurements and metallographic examinations are presented. NSA

N69-15682# Atomics International, Canoga Park, Calif. Liquid Metal Engineering Center.
HNPF PUMP TEST LOOP, FINAL SYSTEM DESIGN DESCRIPTION
4 Sep. 1968 76 p refs
(Contract AT(04-3)-700)
(LMEC-Memo-68-21) Avail: CFSTI

The Hallam Nuclear Power Facility pump test loop system design is described, and the loop functions and capabilities are presented. The test installation provides for: (1) testing Hallam prototype freeze seal and free surface centrifugal pumps; (2) testing a helical rotor electromagnetic pump; (3) evaluation of shellside heat transfer experiments on sodium-to-sodium heat exchangers; (4) calibration of sodium flowmeters; and (5) testing of sodium components such as valves and coolers within pressure, flow, and temperature limits. NSA

N69-15728# Atomic Power Development Associates, Inc., Detroit, Mich.
GAS-WATER SIMULATION STUDIES OF SODIUM-WATER REACTIONS
A. J. Friedland, J. T. Hagstrom, and M. Hori Sep. 1968 77 p
(Contract AT(11-1)-865)
(APDA-226) Avail: CFSTI

The early phases of an experimental and analytical program in which a simulation method for the investigation of the consequences of tube leaks in steam generators of sodium-cooled fast reactor power plants are described. With this method, pressurized gas released into water is used to simulate hydrogen generation in liquid sodium. A mathematical model, coordinated with the experiments, is used to predict results. It is planned to use the data as a basis for modifying the mathematical model and for determining the scaling laws applicable for modeling sodium-water reactions with gas injections into water. Author (NSA)

N69-15737# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
CALCULATIONS OF VACANCY CLUSTER PRODUCTION IN IRON FOR EBR-2, DFR, FTR, AND ETR
G. E. Russcher Sep. 1968 22 p refs
(Contract AT(45-1)-1830)
(BNwL-819) Avail: CFSTI

Calculations of the interactions between neutrons and Type 304 and Type 316 stainless steels and iron are made by use of SPECTRA computer programs. The calculations are performed for the FTR, DFR, EBR-2, and the ETR. NSA

N69-15763# Atomics International, Canoga Park, Calif.
LARGE RADIOISOTOPE HEAT SOURCE CAPSULE PROGRAM, TOPICAL REPORT NUMBER 6: COMPATIBILITY TESTING
E. Benn 15 Sep. 1968 40 p refs
(Contract AT(29-2)-2338)
(AI-AEC-12739) Avail: CFSTI

The Large Radioisotope Heat Source Capsule (LRHSC) Program supports the development of high temperature (2000°F) long life (5 years) radioisotope heat sources. The specific concern of the LRHSC program is to develop the tantalum alloy fuel containing capsule. The LRHSC test program is generating data on biaxial creep, impact deformation, burial temperature distributions and materials compatibility. Progress made in the design, testing, and evaluation of the LRHSC materials compatibility samples during fiscal year 1968 is presented. Test data are presented on interface combinations involving Ta-10W, T-111 (Ta-8W-2Hf), Al_2O_3, Pt-10Rh and iron titanate at temperatures in the range of 2000°F to 2500°F. Author (NSA)

N69-15768# Los Alamos Scientific Lab., N. Mex.
EFFECTS OF REACTIVITY EXCURSIONS ON COATED FUEL PARTICLES
Felix T. Adler (Illinois Univ.) 23 Sep. 1968 52 p refs
(Contract W-7405-eng-36)
(LA-3947) Avail: CFSTI

The breakup mechanism of pyrolytic carbon (PyC) coated fuel particles imbedded in a graphite matrix is investigated with the aim of establishing threshold values for energy deposition rates

necessary to reach cracking of the coating and for the onset of matrix damage. The experimentally observed difference in response between particles containing a uranium carbide core and those containing a uranium oxide core can be understood as the consequence of the formation of CO or CO_2 in the oxide particles during the reactivity excursion. The resulting gas pressures lead to cracking of the shell and breakup of the matrix. Carbide particles develop a sizeable vapor pressure of C or U only at temperatures well above the melting point of uranium carbide. Simple thermomechanical considerations are presented, showing that two different heat transfer mechanisms control the response of the carbide particles to a reactivity pulse. Author (NSA)

N69-15773# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
PLUTONIUM UTILIZATION PROGRAM Technical Activities Quarterly Report, Mar.–May 1968
Sep. 1968 67 p refs
(BNwL-828) Avail: CFSTI

Technical activities and accomplishments are reported on nuclear fuel elements, reactor physics, and the Plutonium Recycle Test Reactor operation. These include gamma ray dose rate from americium oxide source, fission product release rate measurements in irradiated mixed oxide fuel rods, neutron resonance escape probability for uranium 238, and crack propagation characteristics of niobium–zirconium hybrided and unhybrided pressure tubes and Zircaloy-2 pressure tubes. NSA

N69-15774# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Angewandte Reaktorphysik.
DEVELOPMENT OF FUEL ELEMENTS FOR FAST BREEDER REACTORS
H. Beisswenger, H. Blank, H. van den Boorn, D. Geithoff, W. Haefele et al [1968] 423 p refs Transl. into ENGLISH from German rept. KFK-700
(EURFNR-472; EUR-3713.d) Avail: CFSTI

A compilation of papers are presented based on work performed under the United States-Euratom Fast Reactor Exchange Programs. Topics included are: fuel element development as a technical-physical problem, fuel material selection, fuel cycle and fuel element design, fuel costs and fuel element design, fuel rod performance. Additional subjects are: mechanical loading and chemical demands of fuel element cladding, radiation tests of cladding materials, cladding material selection. Items are presented on: design and execution of fuel element irradiation experiments, examination of irradiated fuel elements, and mass transport in oxide fuels. D.H.B.

N69-15855# Naval Radiological Defense Lab., San Francisco, Calif.
SEAWATER CORROSION STUDIES OF SNAP-21 MATERIALS
Donald A. Kubose, Ming G. Lai, Harry A. Goya, and Herman I. Cordova 3 Dec. 1968 47 p refs
(Contract AT(49-5)-3002)
(AD-678455; USNRDL-TR-68-109) Avail: CFSTI CSCL 18/14

The corrosion rates of several SNAP-21 materials measured in seawater at ambient room temperature and pressure (Hastelloy C, Hastelloy X, Titanium-621, Beryico-165) have been compared to those measured in 200C seawater vapor (Hastelloy C, Hastelloy X), in seawater under a hydrostatic pressure of 7000 psi (Hastelloy C, Titanium-621, Beryico-165) (23C) and in seawster in an ionizing radiation field of 200,000 r/hr (Hastelloy C, Hastelloy X) (30C). Significant increases in corrosion rate were observed only for Hastelloy C and Hastelloy X in hot seawater vapor (approximately two orders of magnitude) and for Hastelloy C in seawster under high hydrostatic pressure (approximately an order of magnitude). Author (TAB)

N69-16070# United Nuclear Corp., Elmsford, N. Y.
FAST REACTOR MIXED-CARBIDE FUEL ELEMENT DEVELOPMENT PROGRAM Quarterly Progress Report, Jan.–Mar. 1968
J. C. Andersen and A. A. Strasser 10 Jul. 1968 51 p refs
(Contract AT(30-1)-3415)
(UNC-5217; QPR-3) Avail: CFSTI

The status of the UC–PuC pellet rod irradiations in EBR-II is summarized. Mixed-carbide annular pellet irradiation capsule assemblies are described, and the specimens prepared for fission gas release testing are tabulated. Sodium-bonded carbide fuel irradiation capsule design is shown. High-density UC, UC–PuC, and UO_2–PuO_2 specimens were fabricated, and the kinetic and thermodynamic compatibility of mixed-carbide fuel with stainless steel-cladding was evaluated. NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-15074# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
OPTICAL ANISOTROPY OF THE SAFETY GLASS IN THE 5-METER HYDROGEN CHAMBER
A. Zapletal 1968 36 p refs In RUSSIAN
(JINR-P13-4059) Avail: CFSTI

The data are presented for determination of the optical anisotropy of the 5-meter bubble chamber safety glass. Author (NSA)

N69-15079 Houston Univ., Tex.
FINITE DIFFERENCE SOLUTIONS OF THE ACOUSTIC RADIATION EQUATION IN THE NEAR FIELD
Yeh-Pei Lu (Ph.D. Thesis) 1967 57 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-6877

Numerical methods for the solution of the finite difference approximation to the acoustic radiation equation are discussed. For a spherical radiator, the Gauss–Seidel iterative method and the alternating direction implicit method are employed to solve the discrete approximation of the Helmholtz equation in the near field. Emphasis is on the development of the general numerical method and on the extrapolation scheme used to increase the rate of convergence. Measures of the number of calculations needed for various methods of solution are reported. A discussion of the nature of the acoustic radiation problem in numerical computation is also presented. Dissert. Abstr.

N69-15254# Industrial Science and Technology Agency, Tokyo (Japan). Electrotechnical Lab.
STUDY ON DIELECTRIC MEASUREMENTS AT THE MICROWAVE REGION
Hideo Yamanaka May 1968 147 p refs In JAPANESE; ENGLISH summary *Its* Res. No. 683
Avail: CFSTI

New and improved methods for the measurement of dielectrics at microwave frequencies are discussed. Using chiefly the perturbation theory and variations of the resonant cavity method, dielectrics in several different forms are examined. Spherical, cylindrical, thin-sheet, and flat-plate dielectrics are included in the study. Experiments were also conducted with a line length variation method in which a short plunger of the cavity is driven by a reversible motor and the cavity output is recorded by an X–Y recorder. Problems arising from the thermal expansion of the

resonator and the sample, a tapered waveguide, the differential of the Q curve, and effects of the dielectrics on the propagation constant of waveguides are also treated. The work of other investigators is reviewed and related to this study. K.W.

N69-15256# Brookhaven National Lab., Upton, N. Y.
AC LOSSES IN MAGNETS MADE OF Nb_3Sn RIBBON
G. H. Morgan and P. F. Dahl 1967 9 p
(BNL-12889) Avail: CFSTI

Experiment results of a study of the ac losses in magnets made of commercially available 1/2 in. wide Nb_3Sn ribbons are summarized. A comparison with theory is also presented. NSA

N69-15296# University Coll. of Northern Wales, Bangor. Dept. of Chemistry.
SUB-MILLIMETER WAVE GENERATION AND SPECTROSCOPY Final Scientific Report, 1 Sep. 1965-31 Jun. 1968
John Sheridan 1 Jun. 1968 26 p refs
(Grant AF-EOAR-90-65)
(AD-677338; AFOSR-68-2200) Avail: CFSTI CSCL 7/4

Two arc-type harmonic generators (Froome generators) have been made for the multiplication of microwave frequencies (30-40 Gc) into the sub-millimeter range. They have been tested to withstand pressures of over 1000 atmospheres and facilities have been established for filling them with argon, or argon-hydrogen mixtures, to such pressures. Elaborate electronic devices have been established and tested for driving these generators with 20 watts of microwave radiation at 30-40 Gc, obtained from a M-type carcinotron. The first operation of the arc-generators was achieved in an exploratory manner. High performance millimeter wave microwave spectrometers were set up, equipped both with conventional harmonic generators and with the facility to use also the Froome generators as sources. The efficiency of conventional devices was maximized in order to permit a critical comparison of Froome generators with point-contact multipliers as sources for high-resolution spectroscopy. Author (TAB)

N69-15379# Naval Ordnance Lab., White Oak, Md.
UNDERWATER SOUND MEASUREMENTS FROM AN AIRCRAFT
Robert J. Urick and Cylde E. Relly 17 Jun. 1968 18 p refs Presented at the 4th Natl. ISA Marine Sci. Instrumentation Symp., Jan. 1968
(AD-677279; NOLTR-68-99) Avail: CFSTI CSCL 17/1

Sonobuoys can be used for underwater sound measurements from an aircraft in flight. In testing the feasibility of this idea, two series of field experiments were performed to yield data on bottom reflectivity and volume reverberation over wide areas of the Atlantic. Standard sonobuoys were modified by adding calibration circuitry to permit absolute measurements. The method yields great rapidity and mobility in data collection relative to shipboard measurements. Author (TAB)

N69-15393# California Univ., Livermore. Lawrence Radiation Lab.
TLD SUPRALINEARITY AND OPTICAL ABSORPTION IN LiF CRYSTALS
R. M. Grant and D. E. Jones 4 Sep. 1968 8 p refs Presented at 2d Intern. Conf. on Luminescence Dosimetry, Gatlingburg, Tenn., 23-26 Sep. 1968
(Contract W-7405-ENG-48)
(UCRL-71090; CONF-680920-2) Avail: CFSTI

The thermoluminescence (TL) of irradiated LiF:Mg crystals has been shown to be linear with dose over a certain range, after which it rises more sharply in a region of supralinearity before saturating at high doses. Several investigators have shown that the relative sensitivity (TL/R, where R is the exposure dose) of this phosphor in the supralinear region depends on the quality of the radiation as well as on the total dose. This paper reports an experiment designed to measure both the radiation-quality-dependent TL supralinearity and the simultaneous changes in two of the optical absorption bands (250 nm and 310 nm) of TLD-100. The samples were 1-cm cubes cleaved from a small portion of a large ingot. For TL measurements some of the cubes were powdered. Optical measurements were made after each increment of exposure while TL measurements were made at the end of all irradiations. Small samples of the powder were removed for subsequent TL reading after each exposure increment. Author (NSA)

N69-15401 Oklahoma State Univ., Stillwater.
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF ELECTROMAGNETIC SCATTERING FROM A KNOWN, ROUGH SURFACE
Dupree Maples (Ph.D. Thesis) 1967 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-8451

In the experimental investigation a photo-reflectometer system was employed, which used a gas laser as a source and photographic film as a detector. The angle of incidence was varied from 10 to 80 degrees. A sawtooth surface profile was used as the reflecting surface. The film was read on a densitometer to obtain the relative intensities of the reflected energy. The theoretical investigation revealed that the energy incident on a periodic surface was reflected in lobes. The largest lobes were not specularly reflected as normally expected. The experimental investigation revealed that the energy was scattered in lobes. The largest lobes were not reflected in the specular direction. The comparison between the experimental and theoretical results revealed that the theoretical model predicted approximately the angular location of the reflected energy. The comparison, also, indicated the model's inability to predict the magnitude of the reflected energy. Dissert. Abstr.

N69-15426#
ACOUSTIC VIBRATIONS IN A CAVITY HAVING SOURCES AND SINKS
Iv. I. Babenko et al [1968] 9 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 4, 1968 p 87-92
Avail: CFSTI

A method permitting the relaxation time of free acoustic vibrations in a cavity of arbitrary geometric shape to be obtained, and also the stability boundary directly from an examination of the boundary value problem is discussed. The more general case when the sources and sinks resemble a solid wall is examined here. The sources and sinks are assumed to be of two kinds, similar to a wall and to a hole. Free and forced vibrations are both analyzed. Author

N69-15431# National Aeronautical Establishment, Ottawa (Ontario).
AN INVESTIGATION OF THE NEAR NOISE FIELDS OF A CHOKED AXISYMMETRIC AIR JET
R. Westley and J. H. Woolley Jun. 1968 38 p refs
(AD-677349; NAE-LR-506) Avail: CFSTI CSCL 20/1

An experimental investigation was completed of the near sound field of a choked axisymmetric air jet of 2.25-in diameter. The results include surveys of the sound pressure levels in the area surrounding the jet and the identification of various screech frequencies. A schlieren system with stroboscopic spark synchronisation was used to photograph an axisymmetric mode and a spiralling mode of the jet oscillations. Author (TAB)

N69-15434# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y. Dept. of Electrophysics.
SCATTERING AND PROPAGATION OF ELECTROMAGNETIC WAVES IN BOUNDED PARAMETRICALLY MODULATED MEDIA

S. Peng Jun. 1968 143 p refs
(Contract AF 49(638)-1402)
(AD-677333; PIBMRI-67-1374) Avail: CFSTI CSCL 20/6

Scattering and propagation of electromagnetic waves in bounded, parametrically modulated media are investigated. The particular case is examined where the permittivity of a dielectric medium is modulated in a wave-like manner in time and space. Such a medium represents a linearized description for nonlinear effects due to a high-intensity pump wave, valid for incident waves of low-intensity. The investigation starts with the analysis of dispersion relations for the determination of temporal and spatial instabilities of waves propagating in an active distributed, parametrically modulated medium. It is found that, in a medium with basic dispersion, four types of parametric interactions are possible, namely: a contra-flow, active interaction which results in temporal instability; a co-flow, active interaction which results in spatial instability; a contra-flow, passive interaction; and finally, a co-flow, passive interaction. The last two types of interaction are temporally as well as spatially stable. The boundary value problems of parametric media of finite extent are formulated for the cases of temporally stable interactions, so that a steady state analysis is permitted. Author (TAB)

N69-15474# Iowa State Univ. of Science and Technology, Ames. Dept. of Physics.
PHOTOELECTRIC FRINGE STRENGTH MEASUREMENT
W. I. Beavers and W. D. Swift [1968] 30 p refs Submitted for publication
Avail: Issuing Activity

Experiments in photoelectric measurement of interference fringe strengths by means of a scanning photometer are described. The observed performance of the system is compared to the theoretical prediction for such a configuration. Signal to noise ratio variation and turbulance effects are studied. A high precision measurement of source angular diameter with this technique is demonstrated. Author

N69-15564 Texas Univ., Austin.
THE EFFECT OF MAGNETIC FIELD INTENSITY ON THE SPEED OF SOUND IN ULTRAPURE CADMIUM AND COPPER
Bill Gwock Wing Yee (Ph.D. Thesis) 1967 96 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-4366

The relative velocity of sound in ultrapure single crystal cadmium and copper was measured as a function of magnetic field intensity for compressional waves propagated in the [$1\bar{2}10$] direction of cadmium and the [110] direction of copper. All the experiments were performed with the magnetic field perpendicular to the direction of propagation at frequencies of 33 MHz and 55 MHz and at a temperature of 4.2°K. The method used in the measurements was a continuous wave resonance technique based on the principle that sound waves form standing wave patterns within the composite system of quartz transducers, bonding materials, and the sample. At a frequency of 33 MHz the change in the velocity was measured with an accuracy of about one part in 5×10^6, and at a frequency of 55 MHz with an accuracy of about one part in 3×10^6. The results of the measurement are in general agreement with theories based on a free electron model. Dissert. Abstr.

N69-15677 Stanford Univ., Calif.
STUDIES IN NONLINEAR OPTICS
John Lester Emmett (Ph.D. Thesis) 1967 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-6410

In the present investigation we have studied the scattering of intense light by transparent liquids. For this work a pulsed ruby laser was developed which generated 300 Mw, 10 nanosecond pulses with a spectral width of 250-350 megacycles. A discussion of the mode selection techniques required to achieve single longitudinal mode operation at such high peak powers is presented. With this laser we have been able to achieve stimulated Raman and stimulated Brillouin scattering transverse to the laser beam without the necessity of external resonators. In this geometry, we have made frequency shift measurements of stimulated Brillouin scattering without frequency pulling resulting from coupling between the laser and the scattering medium. We have thus found that the stimulated measurements of the hypersonic velocity agree with those from spontaneous measurements. We have determined the hypersonic velocity in $SiCl_4$ as 780 ± 20 m/sec where no previous measurement exists. Dissert. Abstr.

N69-15589# Technische Hochschule Munchen (West Germany).
THE DISCHARGE AND BREAKDOWN AT HIGH CONTINUOUS VOLTAGE IN AIR [DER DURCH- UND UEBERSCHLAG BEI HOHER GLEICHSPANNUNG IN LUFT]
Egon Peschke (Ph.D. Thesis) 1968 256 p refs In GERMAN
Avail: CFSTI

Causes of impulse flashover and breakdown in high voltage DC power transmission were studied by measuring the effects of sparkover, counterelectrode, electrode shape, air moisture content, and temperature on rod-plate gaps as well as on rod-rod spark gaps at maximal voltages. Confirmed was the proportional correlation between breakdown voltage and spark length. A high degree of air humidity increased negative breakdown voltage by a factor of two in the unsymmetric rod-plate gap arrangement in comparision with the positive system. Thus, the more stable distribution of breakdown values, the linearity of gap distance, and a more stable polarization recommend the rod-rod system as most advantageous spark gap arrangement for high voltage DC transmission. Transl. by G.G.

N69-15607 Ohio State Univ., Columbus.
TRANSIENT CURRENTS ON A PERFECTLY-CONDUCTING CYLINDER ILLUMINATED BY UNIT-STEP AND IMPULSIVE PLANE WAVES
Robert Henry Schafer (Ph.D. Thesis) 1967 214 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 68-8877

An analytical study of the transient current density induced upon the surface of a perfectly conducting circular cylinder has been carried out. Both TE and TM incident plane waves are considered. The time dependence of the incident wave is chosen to be either that of a unit impulse or a unit step. Since exact, closed form solutions for the induced current density cannot be derived, it is necessary to separately consider the current density for small and large time intervals after the arrival of the incident plane wavefront. Using this approach, asymptotic representations of the induced current density are derived which are valid in the two extreme time ranges. The large and small-time approximations do not over-lap in the moderate time zone. Dissert. Abstr.

N69-15645 Ohio State Univ., Columbus.
INTERPRETATION AND APPLICATION OF TRANSIENT AND IMPULSE RESPONSE APPROXIMATIONS IN ELECTROMAGNETIC SCATTERING PROBLEMS
David Lloyd Moffatt (Ph.D. Thesis) 1967 234 p
Avail: Univ. Microfilms: HC $10.60/Microfilm $3.05 Order No. 68-8859

A linear system analysis is applied to electromagnetic scattering problems. The concept of impulse and transient response approximations in electromagnetic scattering problems and the general properties of such waveforms are reviewed. It is demonstrated that the impulse and transient response waveforms provide a primary conceptual model for electromagnetic scattering which permits the integration of all existing frequency data, calculated or measured, and is simple in form. The model is directly related to the geometrical and physical properties of the scattering object; does not change drastically for small perturbations of parameters; and can be used to predict the response of the object

to any type of incident plane wave. Analytical and experimental methods for obtaining estimates of the response waveforms are discussed, and a systematic procedure for securing such estimates is suggested. Dissert. Abstr.

N69-15646 Ohio State Univ., Columbus.
OPTICAL HETERODYNE DETECTION OF A RANDOMLY DISTORTED SIGNAL BEAM
James Patrick Moreland (Ph.D. Thesis) 1967 131 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-8860

The purpose of this investigation is to determine that time invariant detection scheme which yields the largest average signal-to-noise ratio in the heterodyne detection of a randomly distorted optical signal. The important results of the investigation are: The detection scheme may be realized, simply, by properly shaping the isophase surface and the intensity pattern of the local oscillator beam. No pre-processing of the received optical signal can lead to further improvements. It is shown that both the phase and amplitude depend on the mutual coherence function of the received beam. It is shown that this result, derived formally by the calculus of variations, is also a rather simple consequence of the Karhunen–Loève theorem. For an atmospherically distorted optical plane wave, it is shown that, the increase in average signal-to-noise ratio, over the plane wave case is negligible. Dissert. Abstr.

N69-15667 Michigan State Univ., East Lansing.
EXPERIMENTAL INVESTIGATION OF THE MODIFICATION OF THE BACKSCATTERING CROSS SECTIONS OF METALLIC OBJECTS
Mervin C. Vincent (Ph.D. Thesis) 1967 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-7980

An experimental investigation on the backscattering cross sections of the metallic objects of various shapes are presented. The metallic scatterers are assumed to be illuminated by a plane electromagnetic wave at normal incidence. The modification of the backscattered fields of these targets are accomplished by employing the impedance loading method or the compensation method. The bandwidths of the impedance loading and the compensation methods employed for modifying the backscatters of the above objects are improved by either using a coaxial line (or cavity) with a high characteristic impedance or adding a resistive component to the impedance loading. Dissert. Abstr.

N69-15709 Washington Univ., St. Louis, Mo.
SOUND ABSORPTION IN MODEL QUANTUM SYSTEMS
Joel Alan Snow (Ph.D. Thesis) 1967 170 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-5155

The basic covariance functions of the theory are calculated for the non-interacting Boltzmann, Fermi–Dirac, and Bose–Einstein gases. Detailed numerical calculations are then given for the sound amplitude. The characteristic features of the response, depending upon the type of statistics employed, are examined in detail. The attenuation of high frequency ultrasound is calculated within the framework of the Bardeen–Cooper–Schrieffer model of superconductivity. The contribution to the attenuation resulting from the destruction of Cooper pairs is discussed in detail, and the relevance of this contribution to experimental determination of energy gaps is examined. A similar calculation is then carried out for superconductors containing paramagnetic impurities. Such superconductors serve as a prototype for a large class of systems in which an interaction is present which is not symmetric under time reversal. The contribution due to the destruction of Cooper pairs is shown to be drastically altered by the presence of the impurities. Dissert. Abstr.

N69-15734*# California Univ., La Jolla. Dept. of Applied Electrophysics.
BANDLIMITED IMAGE RESTORATION BY LINEAR MEAN-SQUARE ESTIMATION
Charles L. Rino [1968] 24 p refs
(Grant NGR-05-009-079)
(NASA-CR-99048) Avail: CFSTI CSCL 20F

A linear mean-square estimator optimum for data available only on a finite interval is derived for the restoration of images degraded by a system with a bandlimited spread function. The analysis is carried out in one dimension using a prolate spheroidal wavefunction expansion of the image process. It is shown that if the noise is bandlimited to the same bandwidth as the spread function, the expansion represents the image process with zero mean square error on the entire interval, and the estimate of the geometrical image achieves the same mean-square error as the optimum estimate for data on the infinite interval. The rate at which the estimate converges is discussed and an example presented. Author

N69-15753*# California Univ., La Jolla. Dept. of Applied Electrophysics.
THE APPLICATION OF SIGNAL DETECTION THEORY TO OPTICS
Carl W. Helstrom 15 Dec. 1968 29 p refs
(Grant NGR-05-009-079)
(NASA-CR-99050) Avail: CFSTI CSCL 20F

Progress in research on the application of signal detection theory to optics is described. The quantum-mechanical threshold detector for an incoherent object observed against a background of thermal light has been derived and its performance analyzed. Curves of detection probability versus signal strength for coherent and incoherent optical signals in thermal noise are presented. A method for calculating cumulative probability from a moment-generating function is proposed. The restoration of degraded images is treated as a problem in statistical estimation theory. Author

N69-15785# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
A FOCUS ERROR SENSOR FOR A SATELLITE OPTICAL SYSTEM
D. W. Swift Paris ESRO Nov. 1966 24 p
(ESRO-TM-P-125-ESTEC) Avail: CFSTI

A possible practical design for a focus error sensor is described, with the purpose of demonstrating the feasibility of such a device. An optical-bench version of the design has been constructed and tried out in the laboratory, and has been found to operate according to expectations. This paper thus completes the feasibility study reported in TM-P-121. ESRO

N69-15794# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF ACOUSTICS (SELECTED ARTICLES)
8 Nov. 1967 28 p refs Transl. into ENGLISH from Sheng Hsueh Hsueh Pao, v. 1, no. 1, 1965 p 2–6 and 14–21
(AD-678345; FTD-HT-23-702-67) Avail: CFSTI CSCL 20/1

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N69-15795# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE DIRECTIONAL DISTRIBUTION OF SOUND FIELD AND ITS MEASUREMENT

Chen Tung *In its* J. of Acoust. 8 Nov. 1967 p 1–7 refs (See N69-15794 05-23)

Avail: CFSTI

The directional characteristic of a microphone is an important factor in the measurement of directional distribution of a sound field. The relations between measured and original distributions are derived. Some components of the directional distribution of a sound field n be calculated from the measured distribution. This is especially important when the directivity of the microphone used is not high. The information about the directional distribution of a sound field which can be obtained from the measurements are limited by the directional characteristic of the microphone. The nonuniformity of the measured directional distribution is usually less than that of the sound field. Author

N69-15796# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE SURFACE WAVES GENERATED BY A VIBRATING SIDE WALL

Li Pei-zi *In its* J. of Acoust. 8 Nov. 1967 p 8–23 refs (See N69-15794 05-23)

Avail: CFSTI

The method of functions of complex variables was used in solving the problem of small amplitude water surface waves generated by a vibrating side wall. The general formula for the complex velocity is given, and three different types of wall vibrations are discussed in some detail. Two different methods were used for the measurement and recording of surface waves. The experimental results in the case of small amplitude agreed well with theory. Some observations were made with large amplitudes. Second subharmonic vibrations were observed in the surface waves when the driving frequency was above a certain critical value. This phenomenon is yet to be accounted for theoretically. Author

N69-15893# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.

LARGE ASTRONOMICAL SATELLITE IN-FLIGHT FOCUSING

D. W. Swift Paris ESRO Aug. 1965 23 p refs

(ESRO-TM-P-121-ESTEC) Avail: CFSTI

As was shown in TM-P-55, a system for in-flight focusing for the Large Astronomical Satellite experimental package will probably be required. This paper examines the feasibility and requirements of such a system and draws some conclusions concerning the design and siting of the components. ESRO

N69-15918*# University Coll. of North Wales, Bangor. School of Engineering Science.

THE APPLICATION OF THE SCANNING ELECTRON MICROSCOPE TO STUDIES OF CURRENT MULTIPLICATION, AVALANCHE BREAKDOWN AND THERMAL RUNAWAY. PART 1: GENERAL PHYSICAL BASIS

P. R. Thornton, D. V. Sulway, and D. A. Shaw [1968] 45 p refs

(Grant NGR-52-117-001)

(NASA-CR-99058) Avail: CFSTI CSCL 20F

The physical basis and practical limitations of the quantitative extension of scanning electron microscopy were studied. The effects of current multiplication leading to contrast in the scanning electron microscope are qualitatively analyzed, and the experimental systems for exploiting these contrast mechanisms are assessed. Problems involved in avalanche studies because of the variability in noise behavior are discussed. Although the study is limited to diodes, the method can also be applied to breakdown processes in bulk devices, such as Gunn diodes, and to such dielectric structures as passivating layers and thin film capacitors. K.W.

N69-15919*# University Coll. of North Wales, Bangor. School of Engineering Science.

THE APPLICATION OF THE SCANNING ELECTRON MICROSCOPE TO STUDIES OF CURRENT MULTIPLICATION, AVALANCHE BREAKDOWN AND THERMAL RUNAWAY. PART 2: GENERAL STUDIES, MAINLY NON-THERMAL

D. V. Sulway, R. C. Wayte, and P. R. Thornton [1968] 47 p refs

(Grant NGR-52-117-001)

(NASA-CR-99041) Avail: CFSTI CSCL 20F

A basic study was conducted to isolate the sources of excess noise in some Read diodes intended for use as microwave oscillators. Conventional experimental methods were used: a charge collection current was induced in a p-n junction by a scanning electron beam to control the brightness of a cathode ray tube scanned in synchronism with the primary beam. In this way, maps of the charge collection signal were obtained. The signal was exploited in two ways: (1) with the primary beam constrained to move along a preselected line, the signal was fed to the y plates of a cathode ray tube or of an X-Y recorder, the X deflection of which was controlled by the time base moving the primary beam; (2) with the primary beam kept stationary at a preselected spot, the bias on the diode was ramped up to a maximum value and down again, and the beam-induced signal was recorded as a function of time (i.e., diode bias). Where relevant, surface micrographs of the device were obtained by the scanning electron microscope. K.W.

N69-15920*# University Coll. of North Wales, Bangor. School of Engineering Science.

THE APPLICATION OF THE SCANNING ELECTRON MICROSCOPE TO STUDIES OF CURRENT MULTIPLICATION, AVALANCHE BREAKDOWN AND THERMAL RUNAWAY. PART 3: THERMAL RUNAWAY IN MULTI-EMITTER POWER TRANSISTORS

D. V. Sulway and P. R. Thornton [1968] 64 p refs

(Grant NGR-52-117-001)

(NASA-CR-99057) Avail: CFSTI CSCL 20F

The application of the scanning electron microscope to complement electrical measurements in the study of thermal effects under non-avalanching conditions is described. The device studied is a developmental high-frequency, silicon-planar power transistor which is subject to thermal jumps above a certain power dissipation. The thermal jump is represented by a sudden decrease in emitter base voltage and is an initial reversible stage in the buildup of a hot spot which leads first to current crowding and then to irreversible thermal runaway. The experimental method is described, and results are given of a search for a temperature-dependent contrast effective under non-avalanching conditions. The mechanical defects inherent in the device were also studied. K.W.

N69-15937# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.

GEOMETRICAL ACOUSTIC PROPAGATION WITH FREQUENCY DEPENDENCE

L. P. Solomon Apr. 1968 23 p refs

(Grant NSF GK-1889)

(PB-179530; Rept-01357-3-T) Avail: CFSTI CSCL 20A

Since the effects of the medium and the boundary conditions on the acoustic fields are definitely frequency dependent, it is desirable to obtain approximate solutions that reflect this dependence on frequency. Although data are available on propagation losses for signals of different frequencies, geometrical acoustics does not offer a means of comparison. An asymptotic expansion in terms

of inverse powers of the frequency is presented. The first term in the expansion obeys the eikonal equation; all the ray-path solutions obtained from geometrical acoustics are applicable. Here, the first term of the expansion, which is the geometrical acoustic field, is obtained in closed form using a simplified profile in which the first derivative is continuous everywhere. Author (USGRDR)

N69-16086# **NONLINEAR SIGNAL DISTORTION IN LIGHT MODULATION BY MEANS OF ELECTROOPTICAL MODULATORS USING THE POECKELS EFFECT**

V. A. Rozhanskii et al [1968] 3 p refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 13, no. 11, 1968 p 2095–2097

Avail: CFSTI

In this method for calculating nonlinear distortions, the correlation function of the process is determined at the output of a nonlinear inertialess element with a given characteristic. The energy spectrum of the output process is derived from the known correlation function by a Fourier transformation, and the integral of the spectrum is then taken in the frequency band of interest. The results of the integration are separated into useful signal and distortion power. This method is used in this paper to determine nonlinear distortions in electrooptical modulators using a Kerr cell. The dependences of the ratio between useful signal power of second through sixth order nonlinear distortions on the selection of the operating point and the modulation coefficient were computed. K.W.

N69-16092# Oklahoma Univ. Research Inst., Norman. High Pressure Physics Lab.

PVT PROPERTIES OF GASES AT HIGH PRESSURES Final Report

Stanley E. Babb, Jr., Stanley L. Robertson, and G. J. Scott Dec. 1968 160 p refs

(Grants NSF GP-1847; NSF-GP-5839)

Avail: Issuing Activity

A brief history on the concepts of the compressibility for gases is presented. Detailed procedures for accurately measuring temperature, pressure and volume in the laboratory are given. Raw data are recorded as resistance and potentiometer readings, which are reduced to volume, pressure and temperature, with the volume further reduced to density. Experimental details on the compressibility of nickel, argon, nitrogen, and other gases are included. The data are summarized in tables and charts. O.S.

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N39-15021 Wisconsin Univ., Madison.

SCATTERING OF POLARIZED PROTONS FROM He 3

Leroy Waggoner Morrow (Ph.D. Thesis) 1967 133 p

Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-1097

The polarized proton beam from a tandem electrostatic accelerator was used to make asymmetry measurements in He^3 (p,p) He^3 at five energies between 4.00 MeV and 10.77 MeV, for center-of-mass angles between 15° and 156°. The data were used along with earlier polarization and cross section measurements in a phase shift analysis extended down to 1 MeV. Two solutions very similar to two earlier ones were found to fit the data, and a new solution was found which fit the data about as well. When the polarization of the He^3 recoils was computed for the three solutions, it was found that the results for the new solution were in fairly good agreement with recent measurements using a polarized He^3 target. The results for two other solutions were in poor agreement with these data. Certain similarities between the new solution and the phase shifts of high energy nucleon-nucleon scattering were observed. These similarities are discussed. Dissert. Abstr.

N69-15024# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

MESIC ATOMS INTERACTING WITH THE MEDIUM AND THE NEGATIVE MUON DEPOLARIZATION

V. S. Evseev 1968 15 p refs In RUSSIAN

(JINR-P14-4052) Avail: CFSTI

It is shown that the divergences between the predictions of the existing μ^--meson depolarization theory and the experimental data can be eliminated by means of the account of the mesic-atom interaction with the medium after the end of the stage of the mesic-atom transition cascade. New experiments are suggested for the identification of different types of interaction of mesic atoms with the medium. Author (NSA)

N69-15025# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

INVESTIGATION OF THE QUASI TWO-PARTICLE REACTIONS IN THE 4.0 GeV/c NEGATIVE PION PROTON-INTERACTIONS WITH STRANGE PARTICLES INVOLVED

A. A. Kuznetsov, N. N. Mel'nikova, B. Chadraa, V. Boldea, A. Mikhul et al 1968 20 p refs In RUSSIAN

(JINR-P1-4049) Avail: CFSTI

The $\pi^- + p \rightarrow \Lambda^0(\Sigma^0) + K^0$ and $\pi^- + p \rightarrow \Lambda^0(\Sigma^0) + K^{*0}(890)$ reactions in 4.0 GeV/c π^-p-interactions have been investigated. The experimental data on the total and differential cross sections of these processes are given. Production and the decay properties of the $K^*(890)$ resonance in the $YK\pi$ final states have been investigated. The elements of the matrix density have been calculated and the data have been analyzed within the peripheral model with the account of the absorption and the Regge pole model. Author (NSA)

N69-15041 Technische Hochschule Munchen (West Germany).

ON THE ALPHA SPLITTING OF Ac-228 [UEBER DIE ALPHA-VERZWEIGUNG DES Ac-228]

Nikolaus Kaubisch (Ph.D. Thesis) [1968] 58 p refs In GERMAN

Avail: CFSTI

Radiochemical methods are used to separate the ^{228}francium isotope and identify ^{228}actinium in thorium decay. A combination precipitation reaction and ion exchange method obtained ^{228}actinium of high purity from thorium and a computer analysis of the nuclear decay spectrum established the typical ^{228}actinium energy line at 4.27 ± 0.04 MeV. A comparison of this line with the ^{228}thorium peak determined the branching ratio of ^{228}actinium as (5.5 ± 2.2) 10^{-9}. This result is in good agreement with approximated values. Transl. by G.G.

N69-15046 Technische Hochschule Munchen (West Germany).

ON THE HEISENBERG MODEL IN THE PARAMAGNETIC RANGE AND AT THE CRITICAL POINT [ZUM HEISENBERG-MODEL IN PARAMAGNETISCHEN BEREICH UND AM KRITISCHEN PUNKT]

Franz Wegner (Ph.D. Thesis) [1968] 65 p refs

Avail: CFSTI

A diagram method for obtaining the time-dependent correlation function in a Heisenberg model is used to study simultaneous and dynamic spin-spin correlations in a paramagnetic temperature field and at the critical point. Transl. by G.G.

N69-15047# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.

POSSIBLE EXPLANATION OF THE CROSS SECTIONS OF THE p-p ELASTIC SCATTERING AT HIGH ENERGIES IN THE ANGLE INTERVAL FROM 0 LESS THAN THETA LESS THAN 90 DEG

K. D. Tolstov 1968 14 p refs

(JINR-D1-4001) Avail: CFSTI

The differential cross sections of the p-p elastic scattering measured at high energies and in the angle between 0 and 90 degrees are described on the basis of two discrete values of a transverse momentum. NSA

N69-15049# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.

AN INTRODUCTION INTO THE HIGHER SYMMETRIES OF REGGE POLES

A. Sebestyen, K. Szego, and K. Toth 7 Aug. 1968 30 p refs

(KFKI-18/1968) Avail: CFSTI

An introduction into the generalized partial wave analysis is presented. The kinematics of the quasi elastic scattering of particles with different masses is first discussed. Regge theory is then reviewed. The four-dimensional partial-wave analysis of the scattering amplitude is discussed both in the equal and unequal mass case. The analytic properties of a Lorentz-pole contribution are examined in detail. The main properties of the Lorentz group are summarized in the Appendices. NSA

N69-15058 Rensselaer Polytechnic Inst., Troy, N. Y.

A THEORY OF THE THREE-NUCLEON SYSTEM

Michael George Fuda (Ph.D. Thesis) 1967 104 p

Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-6976

Starting from an idea of Lovelace, the use of the unitary pole approximation (UPA) to the two-body t-matrix was justified. In the instance that the tensor force is taken into account. One can expect the UPA to a t-matrix to match that t-matrix on the energy shell up to medium energies (≈80 Mev); and the sue of the UPA. leads to three body binding energies which differ by a small amount from those obtained using the full t-matrix. By introducing the elements of the permutation group, S_3, into the Faddeev equations, the handling of these equations was simplified. Taking advantage of this simplification, the correct equations for the trinucleon in the UPA were derived. A t-matrix perturbation theory was derived which enables one to find the shift in the three body binding energy produced by that part of the t-matrix which is neglected in the unitary pole approximation. Dissert. Abstr.

N69-15059 Florida State Univ., Tallahasee.

THE REACTIONS C 12(He 3, He 3)C 12 AND C 12(He 3, d)N 13, 12 TO 19 MeV

Herman Terry Fortune (Ph.D. Thesis) 1967 160 p

Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-5923

Yield curves for the elastic scattering of ^3He by ^{12}C were measured in 10° intervals from 15° to 175° over the bombarding energy range 12.0 to 18.6 MeV. Inelastic scattering yield curves were measured at selected angles for the same energy range. Detailed angular distributions for both elastic and inelastic scattering were measured at 16, 17 and 18 MeV. The elastic scattering was analyzed with the optical model. For the reaction $^{12}C(^3He,d)^{13}N$, excitation functions from 12.0 to 18.6 MeV and detailed angular distributions at 16, 17 and 18 MeV were measured for deuterons leading to the ground state and first three excited states of ^{13}N. At 19 MeV, angular distributions of deuterons leading to the first seven excited states of ^{13}N were measured. The ground state reaction $^{12}C(^3He,d_0)-^{13}N$ was analyzed with the conventional Distorted Wave Born Approximation. A variety of calculations were attempted, with some success, for stripping to the excited states, all of which are unbound with respect to proton decay. Dissert. Abstr.

N69-15065 Syracuse Univ., N. Y.

REPRESENTATIONS OF SOME NON-COMPACT GROUPS AND APPLICATIONS OF NON INVARIANCE GROUPS TO PARTICLE PHYSICS

Jacob George Kuriyan (Ph.D. Thesis) 1967 60 p

Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-5469

A method is discussed of obtaining the hermitian representations of the Lie algebra of certain noncompact groups considering the representations of related compact groups. To illustrate the method, the representations of the groups O(2,1), O(3,1) and O(4,1) are obtained from those of O(3), O(4) and O(5) respectively, and the degenerate representations of SL(3,R) and SL(4,R) from those of SU(3) and SU(4) respectively. The method generalises easily for groups such as O(p,1), SU(p,1), SL(p,r). To handle groups such as O(p,q), ($p \neq 1, q \neq 1$) using this method, it is necessary to reduce O(p,q) with respect to O(p,q −1). A modest beginning is made in this direction by reducing the continuous representations of O(2,1) with respect to O(1,1). In the entire approach only the well known infinitesimal operator techniques of angular momentum are used and the claim is that this method can be used to study a wide class of problems where noncompact groups are used. Dissert. Abstr.

N69-15066 California Univ., San Diego.

SURFACE PHENOMENA IN FERMI LIQUIDS

Peter Julian Feibelman (Ph.D. Thesis) 1967 230 p

Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 68-6709

A general theory of surface phenomena in Fermi liquids is formulated. The similarities between Classical and Quantum surface motion are studied, the comparison leading to an expression for the surface energy of the liquid. Within the time-dependent self-consistent field approximation, the dynamical modes of the system include Landau's zero-sound waves as well as surface vibrations. Exploiting the close relation between spurious modes and surface waves, and approximate dispersion equation is derived for the latter. The propagation of the surface waves depends on the existence of a gap in the fluid's particle-hole spectrum. Thus in a normal Fermi fluid odd-parity vibrations of sufficiently low wave-number can propagate while even-parity ones are damped. The effect of surface vibrations in the nuclear optical potential is studied. The propagation of such modes is shown to cause a strong absorptive peak at the nuclear surface. The observation of surface waves in He^3 is also discussed. Dissert. Abstr.

N69-15069 Maryland Univ., College Park.

ELASTIC SCATTERING OF PROTONS BY C 14

William Roland Harris (Ph.D. Thesis) 1968 156 p

Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-7024

The differential elastic scattering cross section for protons scattered from C^{14} was measured for energies from 1.0 to 2.7 MeV at center-of-mass scattering angles of 39.2°, 54.7°, 90°, 125.3°, 161.4°. Thin self-supporting carbon foils enriched to 10% C^{14} were used as targets. Outgoing protons were analyzed with a 180° double-focusing magnetic spectrometer at the lower angles, while a solid state detector was used at 161.4°. The experimental data were fitted using a theoretical expression derived from R-Matrix theory and accurate in the Two-Level approximation. Anomalies at incident proton energies of 1.162, 1.294, 1.472, 2.02, 2.074, and 2.48 MeV were observed. Best fit parameters (center-of-mass proton partial width in keV, center-of-mass total width in keV, and

J^{π}) for these anomalies in the order listed are: 5.6, 7.9, 1/2 +; 11., 34., 1/2 +; 415., 419., 1/2 +; 1.7, 14., 5/2 +; 16.6, 47., 3/2 +; 90., 60., $5/2^{+}$. Dissert. Abstr.

N69-15070 Stanford Univ., Calif.
POLARIZATION OF RECOIL PROTONS FROM NEUTRAL PION PHOTOPRODUCTION
David Eugene Lundquist (Ph.D. Thesis) 1967 162 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-6453

The polarization of recoiling protons from photoproduction of neutral pions from hydrogen was measured. The experiment covered a range of primary photon energies from 500 to 1000 MeV and range of π° cm angles from 55° to 130°. With the good recoil proton angle and energy definition of this experiment, new structure in the energy variation of the 90° cm polarization was seen. In particular, the 90° cm polarization is about 80% in the 650 to 700 MeV region and dips sharply at 900 MeV to almost zero. Also a strong dependence of polarization on cm angle was observed from 600 to 850 MeV. These data have been incorporated in phase-shift analyses of meson photoproduction. Dissert. Abstr.

N69-15075 Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SCHEME OF CALCULATION OF INTRANUCLEAR CASCADES
V. S. Barashenkov, K. K. Gudima, and V. D. Toneev 1968 17 p refs In RUSSIAN
(JINR-P2-4065) Avail: CFSTI

The program is described of the calculation of the cascade interactions of particles with atomic nuclei in the energy region from several tens of MeV up to T ≃ 30 GeV. The diffuseness of the nucleus boundary is taken into account; while calculating, the laws of the energy and momentum conservation are observed. Author (NSA)

N69-15090 Rensselaer Polytechnic Inst., Troy, N. Y.
NEUTRON CAPTURE IN LOW ABSORPTION MATERIALS
Robert Wesley Hockenbury (Ph.D. Thesis) 1967 178 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-6978

Neutron capture in sodium, aluminum, iron and nickel has been measured from 1 to 200 keV with a 1.25 meter diameter liquid scintillation detector at the Rensselaer Linac. Many more resonances were observed in the capture measurements of Fe and Ni than have been seen in total cross section experiments. The radiation width or $\sigma_0 \Gamma_\gamma$ has been determined for most of the observed resonances. The radiation widths determined in Fe-56 and Al are not constant from resonance to resonance. Those resonances not previously observed are assigned to p-wave neutrons and the p-wave strength function is computed to be $(0.1 \pm 0.05) \times 10^{-4}$ for both Fe-56 and Ni-58. Dissert. Abstr.

N69-15091# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
ON THE MULTIPLICITY DISTRIBUTION OF HIGH ENERGY PION–NUCLEON AND NUCLEON–NUCLEON INTERACTIONS BEYOND 1 GeV
G. Bozoki, E. Gombosi, M. Posch, and L. Vanicsek (Roland Eoetvoes Univ.) 2 Aug. 1968 21 p refs
(KFKI-20/1968) Avail: CFSTI

The experimentally observed multiplicity distributions of charged secondaries in pion-nucleon and nucleon-nucleon interactions at primary energies above 1 GeV are analysed. It is shown that these distributions can be well approximated by a function of the form $f(n) = c^{-1} \cdot n^{\beta-1} e^{-n^2/\alpha^2}$. The energy dependence of the parameters β and α and that of the average multiplicity, the ratio of the average multiplicity to the dispersion, and the inelastic cross section for the production of n charged secondaries are investigated. Rules for the ratio of the inelastic cross section for the production of n charged secondaries in IIN interactions to that of NN interactions, as well as for the ratio of the average multiplicity of IIN interactions to that of NN interactions are established. Author (NSA)

N69-15092# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
EXTENSION OF THE SL(2,C) SYMMETRY
P. Suranyi 11 Jul. 1968 12 p refs
(KFKI-17/1968) Avail: CFSTI

The SL (2,C) trajectory generating algebra is extended to a SL (2,C) × SL (6,C) algebra in a natural way. Axial-, vector- and pseudoscalar meson trajectory families are generated by the same multiplet; the pion is automatically a conspiring particle with Toller quantum number $J_0 = 1$. Generalized SU(6) relations for Lorentz-pole residues are obtained. Author (NSA)

N69-15093# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
PERIODICAL CHARGE-STATE FLIPPING PHENOMENA IN NEUTRON–PROTON SCATTERING
Gy. Hrehuss and T. Czibok 7 Aug. 1968 41 p refs
(KFKI-19/1968) Avail: CFSTI

Periodical state-flipping phenomena analogous to those occurring in the case of electromagnetic excitations have been found in the case of neutron-proton scattering. The periodical charge-state flipping manifests itself as a corresponding fluctuation in the energy dependence of both the total cross section and the differential cross section at forward proton-angles. The flipping frequency measured is in good agreement with that estimated theoretically making use of a simple model for charge-exchange processes. Author (NSA)

N69-15094 California Univ., Berkeley.
PHYSICAL REGION DISCONTINUITY EQUATIONS FOR MULTIPARTICLE SCATTERING AMPLITUDES
Joseph Constant Coster (Ph.D. Thesis) 1967 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-5705

The discontinuity equations are derived for all singularities of multiparticle scattering functions that enter the portion of the physical region lying below the four-particle threshold. These equations, which are the precise statements of the Cutkosky formulas, are calculated directly from the unitarity equations. The only analyticity properties used are those obtained from the S-matrix macroscopic causality condition. That is, the scattering functions are taken to be analytic in the physical region except on positive-α Landau surfaces, around which they continue in accordance with the well-defined plus-$i\epsilon$ rule. Dissert. Abstr.

N69-15097 Wisconsin Univ., Madison.
REGGE POLE ANALYSIS OF PSEUDOSCALAR MESON-BARYON INELASTIC SCATTERING REACTIONS
Kuruganti Veera Lakshmana Sarma (Ph.D. Thesis) 1968 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-5352

An analysis of the inelastic reactions in pseudoscalar meson-spin-1/2 baryon scattering is made in the framework of Regge pole theory. The analysis indicates that the peripheral models based on boson Regge pole exchanges with SU(3) symmetry for vertices offer an adequate and consistent description of the available data. The observed minima in the differential cross section curves of various reactions of interest have a simple interpretation as consequences of the assumption that the helicity amplitudes vanish at the sense-nonsense and nonsense-nonsense points. Predictions of polarization of the final baryon at high energies are presented and found to be in accordance with the available data. By means of the interference model (Regge exchange plus direct channel resonance) it is shown that the data in the intermediate energy

region on π^-p-charge exchange reaction can be explained by postulating the existence of a $I3/2^-$ resonance with a mass of 2530 MeV and with the quantum numbers Y=1 and I=1/2. Dissert. Abstr.

N69-15098 Stanford Univ., Calif.
ANGULAR DISTRIBUTION OF GAMMA-RAYS FROM INELASTIC NEUTRON SCATTERING NEAR THRESHOLD
Lee Walter Torop (Ph.D. Thesis) 1967 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-6497

The angular distributions of gamma-rays following inelastic neutron scattering, near threshold, to the first excited states of the target nuclei were investigated experimentally and theoretically. Measurements were made using NaI(Tl) crystal detectors and natural targets of iron, cerium and bismuth. Data were obtained for the angular distribution of gamma-rays following inelastic neutron scattering by ^{56}Fe at the center-of-mass energies (of the target nucleus plus incident neutron system) E = 1.71, 1.75, and 1.87 MeV, and by ^{209}Bi at E = 1.04 MeV. The inelastic neutron scattering proceeds via compound nucleus formation. At the excitation energies involved the compound nuclear states are overlapping. Dissert. Abstr.

N69-15099 Purdue Univ., Lafayette, Ind.
TWO-PION EFFECTS ON NUCLEON NUCLEON AND NUCLEON ANTINUCLEON FORWARD ELASTIC SCATTERING AMPLITUDES BELOW PHYSICAL THRESHOLD AND ON NUCLEON ISOVECTOR FORM-FACTORS
Robert Donald Young (Ph.D. Thesis) 1967 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-6380

A dispersion-theoretic calculation of the effects of two pion exchange on the NN and $N\bar{N}$ forward elastic scattering amplitudes below the physical thresholds is performed. The two pion exchange effects on the nucleon isovector form factors are also analyzed by dispersion theory in order to obtain statistically good fits to the latest data for momentum-transfer squared below $-1(BeV/c)^2$ The πNN coupling is determined from the fits. The calculation uses the $N+\bar{N}\rightarrow\pi+\pi$ amplitudes which are obtained from a Cini-Fubini approximation to the Mandelstam representation of the invariant amplitudes, $A\pm$ and $B\pm$, that describes both the $N+\bar{N}\rightarrow\pi+\pi$ and $\pi+N\rightarrow\pi+N$ processes. The N-pole and N_{33}^*-resonance are assumed to dominate the pion-nucleon elastic scattering, and only the resonant, J=I=1 pion-pion interaction is included. Dissert. Abstr.

N69-15115 Rutgers Univ., New Brunswick, N. J.
FOUR AND FIVE BODY REACTIONS IN POSITIVE PION PROTON INTERACTIONS AT 8.5 GeV/c
Monroe Stephen Zane Rabin (Ph.D. Thesis) 1967 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-4549

A sample of 15,000 four prong events has been measured from 60,000 pictures of π^+p interactions in the Brookhaven National Laboratory 80 inch bubble chamber. The momentum of the incident pion beam was 8.5 GeV/c. Events selected for measurement had a final state proton identifiable on the scanning table using ionization and curvature criteria. The measurements were thus restricted to events with a final state proton of momentum less than or equal to about 1 GeV/c. This report is based on those measured events which are consistent with one of the final states $p\pi^+\pi^+\pi^-$ or $p\pi^+\pi^+\pi^-\pi^0$. Little evidence is seen for the existence of the A_1 (mass 1.08 BeV) in the four body final state. In the five body final state the neutral component of the A_2 (mass $\approx$1.28 BeV) is seen to decay into $\pi^+\pi^-\pi^0$ for the first time in π^+ p interactions. Dissert. Abstr.

N69-15116# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
MEASUREMENT OF THE INTERNAL MAGNETIC FIELD BY PERTURBED ANGULAR CORRELATION METHODS
L. Keszthelyi 1968 16 p refs
(KFKI/25/1968) Avail: CFSTI

The method of perturbed γ angular correlations and distributions is outlined, and the application of the perturbed correlation technique to the investigation of nuclear moments and internal magnetic fields is discussed. NSA

N69-15123 Stanford Univ., Calif.
ASYMPTOTIC BEHAVIOR OF FEYNMAN INTEGRALS
James Paul Fink (Ph.D. Thesis) 1967 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-6417

A technique is developed for determining the logarithmic asymptotic behavior of a certain class of convergent integrals and is applied to various Feynman integrals of quantum electrodynamics. A general asymptotic theorem for convergent integrals containing parameters is proved. This theorem gives the logarithmic asymptotic behavior of the integral as any subset of the parameters becomes large while the remaining parameters remain bounded. The asymptotic theorem is then applied to the photon and electron self-energy graphs of quantum electrodynamics. Dissert. Abstr.

N69-15138 Pittsburgh Univ., Pa.
MODEL (s-d) WITH NON-SPHERICAL FERMI SURFACE
Paulo Roberto de Paula e Silva (Ph.D. Thesis) 1967 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-4447

A study is made of the effects of a non-spherical and multiply-connected Fermi surface on the properties of the Ruderman–Kittel–Kasuya–Yosida s–d interaction between localized spins and the conduction electrons. At a critical value of the conduction electron concentration the Fermi surface touches a number of Brillouin zone faces giving rise to a number of necks as in copper and nickel. It is shown that, in this region of electron concentration, the paramagnetic Curie temperature θ exhibits a kink associated with a discontinuity in the exchange stiffness parameter $D \propto \Sigma R^2 J(R)$, where J(R) is the indirect exchange parameter. These effects are expected to be more pronounced in materials with a large number of necks in the multiply-connected Fermi surface. Dissert. Abstr.

N69-15144 Florida State Univ., Tallahassee.
THE REACTION C 12(He 3, ALPHA)C 11, 12 TO 18 MeV
Thomas Jack Gray (Ph.D. Thesis) 1967 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-5925

Yield curves for the reactions $^{12}C(^3He,\alpha)^{11}C$ leading to the ground state, first and third excited states of ^{11}C were measured at selected angles over a ^{3}He energy of 12.0 to 18.0 MeV. Detailed angular distributions for the alpha particle groups leaving ^{11}C in its ground state and first six excited states were measured at bombarding energies of 16, 17, and 18 MeV. Angular distributions for alpha particle groups leaving ^{11}C in its seventh through eleventh excited states at a bombarding energy of 18 MeV are reported. By assuming a configuration mixed ground state for ^{12}C, DWBA pickup calculations were performed for the angular distributions leading to the ground state and first nine states of ^{11}C. Relative spectroscopic factors for the various alpha transitions are reported and are compared to the results of others for $^{12}C(p,d)^{11}C$ reactions which have been reported in the literature. Dissert. Abstr.

N69-15156 Oklahoma State Univ., Stillwater.
ANALYTICAL INVESTIGATIONS OF LAMINAR SEPARATIONS USING THE "CROCCO-LEES MIXING PARAMETER" METHOD
Alexander Robert Peters (Ph.D. Thesis) 1967 146 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-8476

Laminar, two-dimensional, separation pressure interactions in the supersonic and hypersonic regimes were investigated using the Crocco-Lees mixing parameter method. This technique employs three semi-empirical parameters which are related to the mixing, the skin friction, and the mean temperature of the boundary layer. An engineering solution for the pressure distribution on a plate and ramp was sought. This required first determining the behavior of the semi-empirical parameters in the region downstream from the separation point. Existing experimental data were used to establish these correlations. The correlations, which were derived, extend the Crocco-Lees method to the entire interaction. A computer technique was developed for finding the complete pressure distribution by using only the free stream flow conditions and the plate-ramp geometry. The location selected for the separation point controls the shape of the resultant pressure distribution. Dissert. Abstr.

N69-15165 Auburn Univ., Ala.
EVALUATION OF THE BOLTZMANN COLLISION INTEGRAL AS A SUM OF SPHERICAL MOMENTS
Carl Peter Rautenstrauch (Ph.D. Thesis) 1967 42 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-5896

The Boltzmann collision integral is evaluated for arbitrary non-negative integral powers of the molecular velocity and the result given as a sum of spherical moments. The result is obtained for Maxwellian molecules by using algebraic properties of symmetric tensors together with the methods used by Ikenberry and Truesdell in 1956 to evaluate special integrals of the same type. Certain notations are introduced to overcome the problems arising from the presence of inner products $(c \cdot c^*)q$. The final form reduces to the expressions given by Maxwell for values of $n \leq 3$. Dissert. Abstr.

N69-15168 Minnesota Univ., Minneapolis.
THE KINETIC THEORY OF SECOND-ORDER TRANSPORT RELATIONS
Benjamin Joe McCoy (Ph.D. Thesis) 1967 116 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-7357

Second-order transport relations are developed via the Chapman–Enskog theory for structureless and rotating molecules: (1) The Enskog dense gas theory is generalized to arbitrary order in gradients of macroscopic field variables. A constitutive relation for the pressure tensor involving products of velocity gradients is presented in an irreducible tensor formulation. (2) Second-order transport relations are developed and compared for the Boltzmann, Fokker–Planck, and Krook equations for monatomic molecules. (3) The Burnett theory of the heat flux and pressure tensor is generalized to polyatomic models, viz., the rough sphere, the loaded sphere, and the spherocylinder. The general Chapman–Enskog method is developed for these rotating molecules. (4) The Chapman–Enskog method is applied to a kinetic equation with a Fokker–Planck collision operator for which rotational and translational degree of freedom are completely decoupled. Dissert. Abstr.

N69-15169# Technische Hogeschool, Eindhoven (Netherlands).
UNRESTRICTED HARTREE-FOCK MOLECULAR ORBITAL CALCULATIONS ON TRANSITION-METAL COMPLEXES
Franciscus Lambertus Martinus Arnoldus Henricus de Laat (Ph.D. Thesis) 5 Nov. 1968 136 p refs
Avail: CFSTI

Symmetry- and spin-unrestricted Hartree–Fock method, using a single determinant wave function is considered. The conventional Hartree–Fock method is used as a starting point; the unrestricted Hartree–Fock method being arrived at after elimination of the spin and symmetry-restrictions. A spin projection method (single annihilation) is discussed also. Formulae and computer programs are developed for the molecular integrals required; the basic functions in question are of the Slater-type. The symmetry- and spin-unrestricted Hartree–Fock method is applied to the octahedral TiF^{3-}_6 complex (d^1-system). The influence of both the three and four center two electron integrals and the treatment of the core electrons on the quantities to be computed is discussed. Various approximation methods for these integrals are developed. Calculations are carried out with various basic sets and at various metal-ligand distances in which computed values are given for the total energy of the ground state $^2T_{2g}$ as well as that of the excited state ^2E_g, the crystal-field splitting parameter (10Dq), the orbital population, the average expectation value of the S^2-operator and the charge-density and spin-density functions. Author

N69-15173# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
ON THE AZIMUTHAL EFFECTS OF TWO PRONG πN AND THREE PRONG DD EVENTS PRODUCED BY 17.2-GeV/c NEGATIVE PION MESONS
G. Bozoki, E. Gombosi, and G. Suranyi 1968 21 p refs
(KFKI-26/1968/) Avail: CFSTI

A deviation from isotropy in the azimuthal angular distribution of secondary particles of two and three prong pion–nucleon interactions is observed in emulsion at 17.2 GeV/c. Attempts are made using Monte Carlo calculations for the interpretation of these azimuthal effects on the basis of the kinematics of reactions $\pi^- p \rightarrow p\pi^-(k\pi^0)$ and $\pi^- p \rightarrow n\pi^+\pi^-(k'\pi^0)$ and the diffraction dissociation of pions on nuclei. A new method is given for the selection of the contribution of DD interactions from the three prong events. Using this method $\lambda_{DD} = (1065 \pm 288)$m and $\lambda_{DD} = (113 \pm 13)$m are obtained for the mean free path of the diffraction dissociation in emulsion at ≈ 7 and 17.2 GeV/c, respectively. The possible influence of the Deck-effect in case of the three prong events is also investigated. Author (NSA)

N69-15176# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
LEVEL SCHEME OF Sm-147 AND g-FACTORS OF ITS TWO LOWEST EXCITED STATES
E. Bozek, R. Broda, J. Golczewski, A. Z. Hrynkiewicz, R. Kulessa et al Jul. 1968 16 p refs
(INP-620) Avail: CFSTI

The level scheme of ^{147}Sm was investigated by the α–α coincidence method. New levels at 1200, 1300, and 1395 keV were deduced. The existence of the 1180 and 1228-keV levels, tentatively introduced in previous papers, is questioned. The lifetimes of the 122- and 198-keV states were remeasured as: τ(122 keV) = 1.15 ± 0.08 ns and τ(198 keV) = 1.95 ± 0.15 ns. The g-factors of the 122- and 198-keV states were determined by observing the integral rotation of the angular correlations in an external magnetic field. The results g(122) = −0.12 ± 0.07 and g(198) = −0.19 ± 0.07 are compared with theoretical predictions based on the calculations of Kisslinger and Sorensen. Author (NSA)

N69-15182# Atomic Energy Commission, New York. Health and Safety Operations.
LOW DOSE MEASUREMENTS WITH THERMOLUMINESCENT DOSIMETERS
Arthur Shambon and James E. McLaughlin Oct. 1968 11 p refs
(HASL-201) Avail: CFSTI

CaF_2:Mn and LiF systems were investigated for suitability in measuring small amounts of gamma radiation. It was found that

doses as low as 2 mR for the CaF_2:Mn system and 11 mR for LiF can be determined by careful measurement. The CaF_2:Mn shielded dosimeters require a correction of slightly less than 0.5 mR per day due to the ^{40}K radioactivity in the glass surrounding the phosphor. Comparison of CaF_2:Mn dosimeters with film badges exposed to 1.0 R and less showed better results for the CaF_2:Mn dosimeters in the region below 100 mR. The film badge readouts showed sizeable departure from linearity with exposure in this region. When the mean value of a number of dosimeter readouts for each exposure was used, good linear response was found with LiF extruded and pellet dosimeters from 150 R down to 11 mR. Improved heating methods should result in readouts from any dosimeter within 10% of the mean value at each exposure. Author (NSA)

N69-15184# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
PRELIMINARY GROUPING OF IONS IN A HIGH-CURRENT LINEAR ACCELERATOR WITH A LOW-ENERGY OF INJECTION
V. A. Enalskii, V. V. Osipov, A. P. Fedotov, and B. K. Shembel 1967 14 p refs In RUSSIAN
(IFVE-SKU-67-56-K) Avail: Issuing Activity

High-intensity proton beam bunching in a linear accelerator with low injection energy is analyzed by means of a mathematical model. A large value of the bunching factor was obtained for a large modulating signal in the klystron-type buncher. An effective capture in synchronous acceleration was confirmed for the bunch with increased initial velocity dispersion. Author (NSA)

N69-15185# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimentalnoi Fiziki.
T NONINVARIANT SPIN CORRELATIONS IN LEPTONIC DECAYS OF BARYONS
V. V. Solovev and I. S. Tsukerman 1967 20 p refs In RUSSIAN; ENGLISH summary
(ITEF-583) Avail: Issuing Activity

T noninvariant correlations in leptonic decays of baryons ($B_1 \rightarrow B_2 + l + \nu$) are calculated assuming complex form factors and taking into account spins of B_1, B_2, and l particles. All the T noninvariant correlations of different types involving the same spins of two or three particles are shown to be related by linear equations. Possibility of measuring the correlations and its comparison with the computed values are considered. The results of calculations are also compared with contributions to the T noninvariant correlations which are due to electromagnetic baryon-lepton interaction in final state. Author (NSA)

N69-15207# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MAGNETIC DIPOLE INTERACTIONS IN DEFORMED NUCLEI PROPERTIES OF THE K = 1/2 STATES
1968 18 p refs In RUSSIAN
(JINR-P4-4069) Avail: CFSTI

The spin polarization effects in odd-mass deformed nuclei are considered as being caused by the "scattering" of the odd nucleon on the core 1^+ excitations. This leads to the renormalization of the single-particle matrix elements $\langle \sigma_z \rangle$ and $\langle \sigma_+ \rangle$. The corresponding contributions to the magnetic moment are accounted for by using the effective factors g^s_0 and g^+_s, which are calculated by theory. It is shown that the renormalization of the matrix element $\langle \sigma_+ \rangle$ results in the change of the sign of the decoupling parameter for the Nilsson state 1/2⁻ [510]. Author (NSA)

N69-15219# Institute of Nuclear Research, Warsaw (Poland).
Z-DEPENDENCE OF THE STOPPING POWER AT LOW ENERGIES
Andrezej Turos 1968 6 p refs Submitted for publication
(INR-P-924) Avail: Issuing Activity

A relation between the stopping power of a medium and its atomic number is established, which permits calculation of energy losses in substances for which no data are available. Results of calculations for H and He ions of energies from 0.5 to 8 MeV/amu are tabulated. NSA

N69-15232# Bettis Atomic Power Lab., Pittsburgh, Pa.
COLLIDED FLUX DIFFUSION THEORY
D. R. Harris Aug. 1968 33 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-801) Avail: CFSTI

A collided flux diffusion theory is developed and tested by comparison with exact solutions and with conventional diffusion theory solutions. Further improvement is achieved by use of a selected three point (in one dimension) approximation for the scattering integral. Special problems such as diffusion in holes and inclusion of anisotropic scattering are treated. Author (NSA)

N69-15233# California Univ., Davis. Crocker Nuclear Lab.
EXACT EVALUATION OF THE LOWEST ORDER VACUUM POLARIZATION CONTRIBUTIONS TO THE MAGNETIC MOMENT OF THE MUON
Glen W. Erickson and Henry H. T. Liu Jul. 1968 13 p refs
(Contract AT(11-1)-GEN-10)
(UCD-CNL-81) Avail: CFSTI

The contribution of the lowest order vacuum polarization diagram to the anomalous magnetic moment of a lepton is given in closed form for all values of the mass of the virtual pair. The calculation independently verifies Elend's calculation, as corrected by Kroll, and the result, in terms of Spence functions, is simpler than that given by Elend. Attention is directed to some useful but not well-known Spence function identities. Author (NSA)

N69-15236# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.
FLUX DEPRESSION IN A PARALLEL ARRAY OF CYLINDRICAL ABSORBERS
Bruce W. Crawford, Jack P. Friedman, Eric C. Hansen, and Frank D. Judge [1968] 24 p Presented at the 14th Ann. Meeting of the Am. Nucl. Soc., Toronto, 9–13 Jun. 1968
(Contract W-31-109-ENG-52)
(KAPL-P-3460; CONF-680601-3) Avail: CFSTI

The flux depression within an absorbing medium of an infinite array of infinitely long purely absorbing parallel cylinders is calculated. In order to account for the flux depression in this parallel array of cylindrical absorbing regions in few-group diffusion theory calculations, appropriate one-dimensional P, blackness-theory parameters are used. Results show that the self-shielding of an absorbing slab region may be drastically altered by rearranging the absorbing region in the form of an array of cylinders. NSA

N69-15238# Institute of Nuclear Research, Warsaw (Poland).
EQUILIBRIUM DEFORMATIONS OF THE GROUND AND EXCITED STATES IN NUCLEI
Z. Szymanski 1968 24 p refs Presented at the Intern. Symp. on Nucl. Struct., Dubna, USSR, Jul. 1968
(INR-P-920; CONF-680702-5) Avail: Issuing Activity

The deformations of atomic nuclei, i.e., the deviations of their shape from the spherical shape, are discussed. An attempt is made to understand the origin and nature of deformation. Various aspects of the problem such as axial symmetry, higher multipole (hexadecapole) components, deformations of the excited states, potential and kinetic energy in the fission process, etc., are discussed. Author (NSA)

N69-15245# Academia R. P. R., Bucharest. Institutul de Fizica Atomica.
DETERMINATION OF TRANSFER CONSTANTS FOR A SEPARATION COLUMN BY SUCCESSIVE EXCHANGE BETWEEN THERE FLUIDS BY SIMULATION ON AN ANALOG CALCULATOR [DETERMINATION DES CONSTANTES DE TRANSFERT D'UNE COLONNE DE SEPARATION, A EXCHANGE SUCCESIF ENTRE TROIS FLUIDES, PAR SIMULATION SUR UN CALCULATEUR ANALOGIQUE]
I. Covaci and C. Miron 1968 10 p ref In FRENCH
(IFA-IS-51) Avail: Issuing Activity

A method is presented for determination of the transfer constants of a separation column with successive exchange between three fluids by simulation on an analog calculator. Exchange equations for the steady state are used and the form imposed on them by determination of the transfer constants is shown. The method for resolution of the problem is described, and programming of the equations on the analog calculator is given. Experimental results obtained are reported and errors of the method are discussed. The proposed method is simple, rapid, and valid at arbitrary concentrations. Author (NSA)

N69-15246 University of Southern California, Los Angeles.
THE USE OF ANALYTICITY IN THE CALCULATION ON NON-RELATIVISTIC SCATTERING AMPLITUDES
Leonard Schlessinger (Ph.D. Thesis) 1967 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-5816

A method which uses the analytic properties of the off energy shell scattering amplitude T(w) as a function of the complex energy variable w to calculate scattering phase shifts is presented. The method consists of first finding the scattering amplitude for negative (unphysical) values of the energy. Then these results are analytically continued to $w > 0$ using a rational-fraction approximation to obtain the physical scattering amplitude. Several methods to effect the continuation by rational fractions are devised and they are analyzed in terms of simple examples. The continuation method is described for the calculation of non-relativistic two-body S-wave scattering and two-channel scattering and two-channel scattering with Yukawa potentials. Numerical results are given and compared to the results obtained by other methods. It is concluded that this method is a useful tool in the study of scattering problems. Dissert. Abstr.

N69-15247 Johns Hopkins Univ., Baltimore, Md.
PARTICLE DIFFUSION IN A RANDOM GRAVITY WAVE FIELD
Norden Eh. Huang (Ph.D. Thesis) 1967 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-6586

An analysis of particle movements in a stationary, homogeneous random wave field is presented. The analysis is based primarily on the first order linearized wave theory. It is found that the asymptotic value of the mean square displacement of a single particle from its initial position is bounded, and the value $2\zeta^2$. In the relative dispersion of two particles the asymptotic mean square relative separation is $4\zeta^2$. The analysis is extended to the second order to discuss the wave drift current in a random wave field. A series of experiments are also presented which give a quantitative verification of the analytic results. Dissert. Abstr.

N69-15252 Tennessee Univ., Knoxville.
OSCILLATOR STRENGTHS IN MAGNESIUM PORPHIN
Larry Don Johnson (Ph.D. Thesis) 1967 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-3749

Molecular orbitals as linear combinations of atomic orbitals were calculated for magnesium porphin, a chlorophyll prototype. Using these wave functions, oscillator strengths for the electronic transitions were calculated. Full advantage was taken of the D_{4h} symmetry of the porphin nucleus. Group theoretical projection operators were applied to orthonormalized Slater orbitals to form symmetry orbitals. These functions were orthonormalized by diagonalizing their overlap matrix. Dissert. Abstr.

N69-15260# Technische Hochschule, Karlsruhe (West Germany). Inst. fuer Struktur der Materie.
CONSTRUCTION OF AN EXACT SOLUTION OF THE BOLTZMANN EQUATION IN MEDIA WITH CYLINDRICAL GEOMETRY BY SUPERPOSING FUNDAMENTAL MODES (CASE SOLUTIONS IN PLANE GEOMETRY) [KONSTRUKTION EINER EXAKTEN LOSUNG DER ZYCINDERGEOMETRISCHEN BOLTZMANN-GLEICHUNG DURCH SUPERPOSITION EBENER CASE-LOSUNGEN]
T. Nonnenmacher 1 Jun. 1967 35 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-17) Avail: CFSTI

A solution of the stationary Boltzmann equation for monoenergetic neutron transport in homogeneous media with cylindrical geometry and isotropic scattering is constructed by superposing fundamental solutions (Case-solutions). The result is an expansion of the angular flux in a series of Tchebichef polynomials of the first and second kind. These series can be summed up and one finds an exact solution regular at the origin. Author (NSA)

N69-15263# Los Alamos Scientific Lab., N. Mex.
RADIATIVE TRANSFER WITH SCATTERING
G. C. Pomraning (Gulf Gen. Atomic) 4 Oct. 1968 13 p refs
(Contract W-7405-ENG-36)
(LA-4006-MS) Avail: CFSTI

The equation of radiative transfer including the effects of photon scattering is discussed. The case of scattering from a Maxwellian gas of free electrons is considered in detail. The mathematical description of this process in the equation of transfer is formulated in two different ways, one differential and the other integral in character. Both descriptions have the potential of being incorporated into a general-purpose radiative transfer code. Author (NSA)

N69-15264# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BEHAVIOUR OF NUCLEAR MAGNETIZATION VECTOR WHEN POLARIZING MAGNETIC FIELD IS REMOVED
E. Kh. Madiyevskaya et al 5 Jan. 1968 18 p refs Transl. into ENGLISH from the book "Yadernyy Magnitnyy Rezonans" Leningrad, Izd. Leningrad. Univ., 1965 p 64–75
(AD-678334; FTD-HT-23-711-67) Avail: CFSTI CSCL 20/8

The authors consider the method of free nuclear precession in weak magnetic fields and study the transition processes which take place when the polarizing magnetic field is cut off. The behavior of the nuclear magnetization vector is considered for two simple cases: (1) A change in the external field intensity while the orientation is held constant; (2) uniform rotation of the field while its intensity is held constant. In the first case, the vector of nuclear magnetization, which is directed initially along the field, does not change its direction. After a certain relaxation time, its intensity also remains constant. In the second case, the behavior of the vector is considerably dependent on the ratio of angular velocities for the Larmor precession and field rotation. The cases of fast and slow cutoff are considered. Approximate formulas are derived for calculating practical switch-off methods when using the free nuclear precession method for solving problems in metrology, geophysics and geology, radiospectroscopy, archeology, etc. Tab

N69-15280# Technische Hochschule Munchen (West Germany). Fakultaet fuer Allgemeine Wissenschaft.

THE SPIN DEPENDENCY OF RAYLEIGH SCATTERING [DIE SPINABHAENGIGKEIT DER RAYLEIGHSTREUUNG]

Fritz Jaehnig (Ph.D. Thesis) 1968 56 p refs In GERMAN

Avail: CFSTI

A spin dependent form factor approximation was derived for the Rayleigh scattering. Whereas the customary form factor approximation has the scattering amplitude proportional to the electric form factor, the approximation presented here has additionally a spin dependent correction which is proportional to the magnetic form factor while neglecting the trajectory magnetism. Regarding electron characteristics, the Rayleigh scattering amplitude thus depends on electron charge and spin densities only. Neglecting the trajectory magnetism for the 3d transition metals is justified; the correction for the spin dependent form factor approximation amounts to 1%. An examination of the interference of the Rayleigh and Mossbauer scatterings showed that it is not possible to determine the spin dependent part of the Rayleigh scattering amplitude from the interference term. Transl. by K.W.

N69-15281 Syracuse Univ., N. Y.

DYNAMICAL MODELS AND SYMMETRY GROUPS IN PARTICLE PHYSICS

Renato Musto (Ph.D. Thesis) 1967 119 p

Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-7074

How to motivate the existence of an underlying algebraic structure in a system of strongly interacting particles, by imposing very general dynamical requirements is shown. Models taken from potential theory and particle physics in order to introduce two different kinds of groups useful in the description of such systems, namely invariance groups and non-invariance groups are analyzed. In particular an expression for the generators of the non-invariance group for the non relativistic Hydrogen Atom for the quantum mechanical case is given. Dissert. Abstr.

N69-15282 California Univ., Los Angeles.

SOLUTIONS TO THE MONOENERGETIC NEUTRON TRANSPORT PROBLEM IN TWO REGION SPHERES BY THE METHOD OF SINGULAR INTEGRAL EQUATIONS

Ronald David Doctor (Ph.D. Thesis) 1967 172 p

Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-7460

The formalism of Case's normal mode expansion method has been used to obtain a set of exact solutions to the Boltzmann transport equation for infinite and finite two regions spherical geometries. A stationary, monoenergetic neutron distribution, isotropic scattering in the laboratory system and symmetry about the center of the sphere are assumed. Slab type equations in terms of a pseudo-distribution function are obtained by application of a suitable transformation to the integral form of the Boltzmann transport equation. In order to apply the transformation, it is necessary to assume equal total cross sections for the two regions. Attempts to remove this restriction were unsuccessful. A solution for the pseudo-distribution function is written in terms of a complete set of orthonormal eigenfunctions. Dissert. Abstr.

N69-15284# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE PHENOMENOLOGICAL STUDY OF TWO-BODY REACTIONS AT HIGH ENERGY [CONTRIBUTION A L'ETUDE PHENOMENOLOGIQUE DES REACTIONS A DEUX CORPS A HAUTE ENERGIE]

Gilles Cohen-Tannoudji (Ph.D. Thesis—Paris Univ.) May 1968 122 p refs In FRENCH

(CEA-R-3479) Avail: CFSTI

A phenomenological model suited for the description of arbitrary two-body reactions at high energies is presented and applied to the analysis of πN, KN, and $\bar{K}N$ scattering. The idea is that the Regge-pole model does not take into account the whole content of the unitarity relation and has to be modified, as is currently done in one-particle exchange models, so that it may include absorptive corrections. In terms of a rather economical set of free parameters, a satisfactory agreement with all available data is obtained, including the recent evidence for a nonvanishing polarization in $\pi^- p \rightarrow \pi^0 n$ reaction. The parametrization of the amplitudes is re-interpreted in terms of poles and branch points in the complex angular-momentum plane for the crossed channel. Author (NSA)

N69-15298# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.

THREE-DIMENSIONAL RELATIVITY FOR AXISYMMETRIC STATIONARY SPACE-TIMES

Z. Perjes 3 Sep. 1968 9 p refs

(KFKI-23/1968) Avail: Issuing Activity

The equivalence of the axisymmetric stationary vacuum gravitational field problem to a 3-dimensional "relativity theory" in the presence of a certain scalar matter field is shown. An invariant classification can be achieved with respect to the algebraic structure of the 3-dimensional trace-free Ricci-tensor. The extension of these results to electrovac spaces is also discussed. Author (NSA)

N69-15302 Columbia Univ., New York.

PHOTOLYSIS MAPPING

Jack Solomon (Ph.D. Thesis) 1967 56 p

Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-8622

A method is described called photolysis mapping, which can determine the orientation of the transition moment, with respect to the recoil velocity of the products for gas phase photo-dissociations. This method measures the flux of fragments at the wall of a hemisphere when plane polarized light dissociates a molecular gas. If the fragments recoil perpendicular to the transition moment, the angular dependence of the flux at the wall is different than if the fragments recoil parallel to the transistion moment. Photolysis mapping experiments for bromine and iodine photolyzed with visible light indicate that the atoms recoil perpendicular to the transition moment. A photolysis mapping experiment on acetaldehyde photolyzed with ultraviolet light (from a xenon–mercury lamp) indicates that the fragments recoil parallel to the transition moment. Dissert. Abstr.

N69-15328# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ON THE NECESSITY OF NEW MEASUREMENTS OF THE SPIN PARITY OF X(960) MESON RESONANCE

A. N. Zaslavskii, V. I. Ogievetskii, and V. Tybor 1968 14 p refs In RUSSIAN

(JINR-E2-4064) Avail: CFSTI

It is shown that contrary to the widespread opinion, it is impossible to assert, basing on the available experimental data, that the X^0-meson is a pseudoscalar, the spin-parity 2^- seems to be even more preferable. In this case the nonet of pseudoscalar mesons would contain an E^0 (1420)-meson according to the prediction of broken $SU(6)_w$. A method is suggested for solving the alternative 2^- or 0^- for the X^0-meson by measuring both the width of the two-photon X^0-meson decay and the X^0 production cross section in the Primakoff effect. Author (NSA)

N69-15366# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

EFFECTS OF PARTICLE INTERACTIONS ON THE SHAPE OF THE BRAGG CURVE

I. M. Vasilevskii, I. I. Karpov, and Yu. D. Prokoshkin 1968 16 p refs In RUSSIAN

(JINR-P1-4000) Avail: CFSTI

Comparisons were made of calculated and measured Bragg curves for protons, deuterons, and α particles with $\approx$1.3 GeV/c momentum. It is shown that the shape of the curve depends on the geometry of the experiment and that calculations of Bragg curves for high-energy particles should take into account nuclear interactions of these particles with attenuating material. Author (NSA)

N69-15375*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TRANSPORT STUDY OF NEUTRON AND PHOTON ATTENUATION THROUGH LITHIUM HYDRIDE AND TUNGSTEN SPHERICAL MEDIA
John A. Peoples and Daniel Fieno Washington Jan. 1969 33 p refs
(NASA-TN-D-4989) Avail: CFSTI CSCL 20H

The S_n transport theory and a point kernel method were used to study the attenuation of point fission neutrons in LiH and Li^6H; point 8.00 MeV photons in tungsten, and neutrons and secondary protons from a fast reactor through a laminated W-Li^6H shield. The results show that the two methods calculate in agreement neutron and photon doses through these media provided (1) at least a P_3S_{16} transport calculation is used, and (2) for neutron attenuation, the point kernel method uses a distributed neutron removal cross section for Li and Li^6 of 0.1000 cm^2/g and 0.1156 cm^2/g. Secondary photon source strength and distributions in the tungsten shells of the laminated tungsten-Li^6H shield were also determined using a P_3S_{16} transport calculation. Author

N69-15394# Muenster Univ. (West Germany). Institut fuer Theoretische Physik.
NONCOMPATIBLE SYMMETRIES [UNVERTRAEGLICHE SYMMETRIEN]
G. Loeffler 22 Feb. 1968 10 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-15) Avail: CFSTI

A theorem is formulated; its importance for symmetry-coupling follows from a discussion of some examples: inner and outer symmetries are not simultaneous exact symmetries. The result agrees in the case of Lorentz and isospin invariance with the result of Carruthers and Jin, which was derived with field theoretic methods. Author (NSA)

N69-15398 Purdue Univ., Lafayette, Ind.
CONVERSION ELECTRON PARTICLE PARAMETERS IN THE DECAY OF Eu-152 AND Eu-154
Hanna Musa Nasir (Ph.D. Thesis) 1967 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-6337

The internal conversion electron particle parameters of several fast low energy E2 transitions in the deformed nuclei Sm^{152} and Gd^{154} were determined by comparing the electron-gamma direction correlations and gamma-gamma directional correlations displayed by the same source. Special attention was paid to eliminate the effects of scattering in the source, and the corrections caused by the presence of extra-nuclear perturbations of the directional correlations were carefully studied. The results are: 0.122 Mev transition in Sm^{152}; $b_2(E2,K) = 1.60 \pm 0.05$, $b_2(E2,L) = 1.03 \pm 0.05$; 0.245 Mev transition in Sm^{152}; $b_2(E2,K) = 1.72 \pm 0.07$; 0.344 Mev transition in Gd^{152}; $b^2(E2,K) = 1.57 \pm 0.13$; 0.123 Mev transition in Gd^{154}; $b_2(E2,K) = 1.37 \pm 0.07$. The particle parameters of the 0.245 Mev and the 0.344 Mev transitions agree with the theoretical values within the experimental errors. The experimental particle parameters of the 0.122 Mev ground state transitions in Sm^{152} are about 15 percent lower than predicted by theory, and that of the 0.123 Mev ground state transition in Gd^{154} is 25 percent lower. Possible reasons for this discrepancy between theory and experiment is discussed in the text. Dissert. Abstr.

N69-15399# Paris Univ., Orsay (France)
TRANSCRIPTION OF THE QUASI-PARTICLE IN IDEAL SPACE AND THE BOSON METHOD
P. A. Simard May 1968 28 p refs In FRENCH; ENGLISH summary
(IPNO/TH-126) Avail: CFSTI

A transcription of the quasiparticle into the ideal space is written in such a way that all the terms which contribute for the three-quasiparticle system in QTD approximation can be found. Canonical transformations between the ideal quasiparticles are studied. An application to one shell is done with the result that the boson method gives exactly the same spectra as the Kuo method. Author (NSA)

N69-15427# Argonne National Lab., Ill.
SNARG-2D, A TWO-DIMENSIONAL, DISCRETE-ORDINATE, TRANSPORT-THEORY PROGRAM FOR THE CDC-3600
G. J. Duffy, H. Greenspan, S. D. Sparck, J. V. Zapatka, and M. K. Butler Mar. 1968 61 p refs
(Contract W-31-109-ENG-38)
(ANL-7426) Avail: CFSTI

The computer program SNARG-2D for the solution of the two-dimensional neutron transport equation is described; and a simple problem is given. The program is written in FORTRAN 4 for the CDC-3600. NSA

N69-15428# Los Alamos Scientific Lab., N. Mex.
MAJORANA DEPOLARIZATION OF HYDROGEN, DEUTERIUM, OR TRITIUM ATOMS
Gerald G. Ohlsen 1 Oct. 1968 30 p refs
(Contract W-7405-ENG-36)
(LA-3949) Avail: CFSTI

The theory required to follow the behavior of a hydrogen, deuterium, or tritium atom in a time-dependent magnetic field is described. A computer code is included, and some numerical results of interest to the design of Lamb-shift polarized-ion sources are presented. A brief discussion of depolarization effects in pick-up or stripping of two electrons is also presented. Author (NSA)

N69-15432# Southwest Center for Advanced Studies, Dallas, Tex.
RESEARCH IN THE APPLICATION OF SPINORS AND OTHER REPRESENTATIONS OF THE LORENTZ GROUP TO GENERAL RELATIVITY Final Report, 1 Jun. 1966-31 May 1968
Michel Cahen, Istvan Ozsvath, Wolfgang Rindler, and Ivor Robinson May 1968 16 p
(Contract N00014-67-A-0310-0003)
(AD-677344) Avail: CFSTI CSCL 20/10

A wide class of exact solutions with rotating gravitational rays was obtained. A systematic account of exact solutions in vacuum in the presence of electromagnetic fields and in dust-like matter was largely completed. Locally isotropic spaces were studied. All three- and four-dimensional symmetric spaces were listed. Theorems about locally compact groups were established. It was proven that a global spin structure exists for a gravitational field if the second Stiefel-Whitney class of spacetime vanishes. The Lorentz group was investigated from the point of view of quasernions, bivectors and generalized cross-ratios. Work, focusing on solutions of the Boltzmann equation, was done developing a general-relativistic kinetic theory of gases. An analogy between the dynamics of the matter inside the Schwarzchild radius and the dynamical situation in the parallel gravitational field corresponding to the uniformly accelerated frame was discovered. Two further exact solutions of Einsteins field equations were found, as well as all homogeneous solutions to the combined Einstein-Lichnerowicz field equations. The kinematics and the geometry of the finite rotating universe (Ozsvath-Schucking solution) were investigated. Author (TAB)

N69-15433# Tel-Aviv Univ. (Israel). Dept. of Physics.
RESEARCH IN ELEMENTARY PARTICLE PHYSICS Final Scientific Report, 1 Apr. 1966–31 Mar. 1968
Y. Ne'eman 15 Jun. 1968 22 p refs
(Grant AF-EOAR-66-39)
(AD-677336; TAUP-47-68; AFOSR-68-2313) Avail: CFSTI CSCL 20/8

The report summarizes the research performed under the grant. Results include important advances in the description of high-energy phenomena, extensions of the group theoretical methods, and studies of a model explaining the CP-violation in the long-lived component of the K-null–anti-K-null system. A list of the 29 papers generated under the grant is included; and a paper entitled Algebraic Methods in Particle Physics is appended. TAB

N69-15435# Mellon Inst., Pittsburgh, Pa.
STUDY OF ELECTRONIC COLLISION CROSS SECTIONS Final Report
Edwin N. Lassettre Jan. 1968 17 p refs
(Contract AF 49(638)-1668)
(AD-677331; AFOSR-68-2307) Avail: CFSTI CSCL 7/4

Contents: Instrumentation; Intensity anomalies; Relative intensities of vibrational transitions; Singlet - triplet transitions; Electric quadrupole transitions; Inelastic cross section ratios; Elastic scattering cross sections; and Theory of Rydberg series. TAB

N69-15452*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
THE INTERACTION OF OXYGEN ATOMS WITH SOLID SURFACES AT eV ENERGIES Semiannual Status Report, 1 Jun.–30 Nov. 1968
G. D. Magnuson, J. W. Boring, and R. R. Humphris Dec. 1968 6 p
(Grant NGR-47-005-077)
(NASA-CR-99078; EP-4011-103-68U) Avail: CFSTI CSCL 07D

Progress is reported on the interaction of oxygen atoms with solid surfaces at high energies. The accomplishments of the period included: operational capability of the entire neutral beam system; completion of vacuum tests; determination of the cracking patterns of the residual gas analyzer for O_2, CO_2, N_2, Ar, and H_2. B.P.

N69-15461# United Kingdom Atomic Energy Authority, Harwell (England). Nuclear Physics Div.
MEASUREMENT OF AVERAGE NEUTRON CAPTURE CROSS-SECTIONS IN THE MASS REGIONS ABOVE 100
Michael Charles Moxon (Ph.D. Thesis—London Univ.) Jul. 1968 85 p refs
(HL68/3739; NP-17644) Avail: CFSTI

A γ-ray detector was developed to measure neutron capture cross sections in the energy range up to 100 keV. The effect on the efficiency for detecting a neutron capture event of variations in the γ-ray cascade scheme following the event are minimized by having an efficiency proportional to the total γ-ray energy emitted. The effect of the scattered neutrons could be ignored in the measurements reported, as the efficiency for detecting them is low ($\sim 1.5 \times 10^{-4}$ of that for a capture event). Measurements of the capture cross sections were made on the Harwell linear accelerator neutron time-of-flight spectrometer using a 32.5-m flight path giving a nominal timing resolution of 8 ns/m. The values of the capture cross sections for the following nuclei are given: ^{103}Rh, In, ^{116}Sn, ^{117}Sn, ^{119}Sn, ^{120}Sn, ^{122}Sn, ^{124}Sn, ^{165}Ho, ^{181}Ta, ^{197}Au, ^{Nat}Pb, ^{232}Th, and ^{238}U. The neutron strength functions and the ratio of the average radiation width divided by the level spacing were determined from fits to the measured data. Author (NSA)

N69-15465# Paris Univ., Orsay (France). Laboratoire de Physique Theorique et Hautes Energies.
DEDUCTION OF TOLLER'S CLASSIFICATION FROM ANALYTICITY OF HELICITY AMPLITUDES AND FACTORIZATION
A. Capella and A. P. Contogouris Jul. 1968 8 p refs
(LPTHE-TH-68/21) Avail: Issuing Activity

The group-theoretical classification of Regge trajectories is deduced from the analyticity properties of the individual helicity amplitudes and the factorization theorem. Author (NSA)

N69-15468# Virginia Polytechnic Inst., Blacksburg. Dept. of Chemistry.
REACTIONS OF CHARGED AND NEUTRAL RECOIL PARTICLES FOLLOWING NUCLEAR TRANSFORMATIONS Progress Report, Sep. 1967–Aug. 1968
Hans J. Ache Sep. 1968 30 p refs
(Contract AT(40-1)-3602)
(ORO-3602-2; PR-2) Avail: CFSTI

A technique for determination of the oxidation states of a recoil particle when it comes to rest, isotope effects in hot atom reactions, and the crystallochemical reactivity of recoil species after they have become thermalized in a solid matrix are considered. NSA

N69-15478# Deutsches Elektronen-Synchrotron, Hamburg (West Germany). Institut fuer Experimentalphysik.
PION PRODUCTION WITH POLARIZED PHOTONS AND TEST OF VECTOR DOMINANCE MODEL
Chr. Geweniger, P. Heide, U. Koetz, R. A. Lewis, H. Wahl et al Aug. 1968 5 p refs Supported in part by Volkswagenwerk
(DESY-68/44) Avail: CFSTI

Cross section asymmetries for the sum of single π^+ and π^- production with polarized photons were measured. The results disagree with calculations based on the vector dominance model using experimental data of vector meson production in π beams. Author (NSA)

N69-15481# California Univ., Berkeley. Lawrence Radiation Lab.
THE EXCITATION OF UNNATURAL PARITY STATES IN Mg 24, Ne 20, AND O 16 BY INELASTIC α SCATTERING
Mary Reed (Ph.D. Thesis) Aug. 1968 131 p refs
(UCRL-18414) Avail: CFSTI

The excitation of unnatural-parity states ($\pi \neq (-)^J$ in even-even nuclei was studied by inelastic α scattering over the energy range of 33 to 120 MeV. Data are reported for the low-lying states in the three nuclei ^{24}Mg, ^{20}Ne, and ^{16}O. The excitation of unnatural-parity states is forbidden in simple, one-step, direct reaction theories by spin and parity considerations. Since these states are excited with moderately large cross sections, the study of them sheds light on more complicated reaction mechanisms. When the angular distributions for these reactions at the various energies are compared with each other, consistent results are obtained for the natural-parity states and for the 2 - state in ^{16}O. However, for the 2 - state in ^{20}Ne and the 3 + state in ^{24}Mg, unusual angular distributions are obtained which bear no resemblance to the theories. Author (NSA)

N69-15482 Syracuse Univ., N. Y.
PROTON SPIN RELAXATION IN SOLID AND LIQUID HYDROGEN DEUTERIDE OVER THE TEMPERATURE RANGE 1.4°K TO 22°K
Arnold Irvin Feldman (Ph.D. Thesis) 1967 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-7057

The proton spin-lattice relaxation time in both solid and liquid HD containing small amounts of normal hydrogen was determined as a function of temperature, external magnetic field and

ortho-hydrogen concentration, which was varied over several orders of magnitude. Below 10°K, the relaxation was caused by the intrinsic relaxation of the protons on the ortho-hydrogen impurity present in the HD, and cross-relaxation with the main body of protons in the HD itself. Between 12° and 14°K, $1/T_1$ decreases due to a developing cross-relaxation bottleneck between the protons on the ortho-hydrogen and HD molecules as molecular diffusion sets in. Above 14°K and up to the melting point, $1/T_1$ is dominated by the intrinsic relaxation of the protons on the HD molecules due to molecular diffusion. In this temperature region the activation energy for diffusion of the HD molecules, E_{HD}, was measured and found to be 372 cal./mole. Dissert. Abstr.

N69-15488# Johns Hopkins Univ., Baltimore, Md. Dept. of Physics.
NUCLEAR REACTIONS IN LIGHT NUCLEI AND MOESSBAUER STUDIES
Sep. 1968 184 p ref
(Contract AT(30-1)-2028)
(NYO-2028-3) Avail: CFSTI

Studies of the nuclear moments of several rare-earth isotopes were carried out. Accurate values for the magnetic moments of isotopes of Dy and Er were obtained. These values indicate that the present form of the collective model for even-even nuclei is unable to provide close agreement with measured moment values. Work is continuing on the moments of ^{238}U. Much larger Moessbauer effects were observed for this isotope. Other Moessbauer effect experiments were carried out using radioactive sources. Effects were observed in ^{145}Nd. Magnetic studies were carried out on $FeCO_3$. Magnetostrictive side-band effects were observed in iron foils subject to rf magnetic fields. Studies of the ferroelectric transitions in some iron-containing compounds were made. High-temperature studies of the Moessbauer effect in ^{57}Fe have given added information about the behavior of the recoilless fraction, f, and the isomer shift at first-order phase transitions. NSA

N69-15493# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
LOW EXCITED STATES OF ^{54}Mn
A. Balanda, M. Gasior, H. I. Lizurej, and H. Niewodniczanski Jul. 1968 9 p In POLISH
(INP-626) Avail: CFSTI

Low-lying excited states of ^{54}Mn were investigated by means of the reaction $^{54}Cr(p,n)^{54}Mn$ at E_p = 2.7 MeV. The energies of the two first excited states at 54.3 ± 0.5 and 156.9 ± 1 keV were determined from the internal conversion electron spectrum. The ratio of internal conversion coefficients $\alpha_K/\alpha_L + \alpha_M$ for the 54.3-keV transition was found to be 7.1 ± 1. Author (NSA)

N69-15494# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
ENERGY SPECTRA OF SPIN LATTICES IN MAGNETIC CRYSTALS WITH IMPURITIES [WIDMA ENERGETYCZNE SIECISPINOWEJ W KRYSZTALACH MAGNETYCZNYCH ZAWIERAJACYCH DOMIESZKI]
Szczesny Krasnicki May 1968 58 p refs In POLISH
(INP-617) Avail: CFSTI

A general review of existing theories of the energy spectrum in a magnetic crystal containing one or more impurity atoms is given. Only the excited states of the spin lattice are dealt with. The possibilities of experimental checking of the theory are discussed and special attention is paid to the method of inelastic magnetic scattering of neutrons. Author (NSA)

N69-15497# Eidgenossische Technische Hochschule, Zurich (Switzerland).
ENERGY DEPENDENT NEUTRON SPLITTING PROCESSES [ENERGIEABHAENGIGE NEUTRONEN VERZWEIGUNG-SPROZESSE]
Paul Waelti (Ph.D. Thesis) 1968 46 p refs In GERMAN *Its* Dissertation No. 4134
Avail: CFSTI

Energy-dependent neutron branching processes in homogeneous, infinitely extended media are treated from the statistical viewpoint. A model is used which describes the development of neutron density in the energized space. Rather than using the complicated system of the m+1 Boltzmann equations, the model places the neutron transport within the formalism of the time-dependent distribution processes. This results in a relatively simple integral equation. Special consideration is also given to the energy-dependent reactor kinetics and to the correlation function of energy-dependent neutron distribution. The model in addition offers a logical approach for the study of flux phenomena. Transl. by K.W.

N69-15500# Iowa State Univ. of Science and Technology, Ames.
RESONANT PARTICLE MASS STRUCTURE DUE TO A SECOND ORDER POLE
P. V. Ruuskanen and K. E. Lassila 14 Oct. 1968 13 p refs
(IS-1948) Avail: CFSTI

Combined data from previous measurements showing a double-peak structure for the A_2 are found to be well fitted by a double-pole resonance formula $N(E) \propto (E-E^2_0)/[(E-E_0)^2 + \Gamma^2/4]^2$. A general formula for the cross section is presented from which the double-pole resonance follows as a special case. Other implications of the proposed model are discussed. NSA

N69-15507# Minnesota Univ., Minneapolis. John H. Williams Lab. of Nuclear Physics.
NUCLEAR PHYSICS Annual Report, 1968
Aug. 1968 224 p refs
(Contract AT(11-1)-1265)
(COO-1265-67) Avail: CFSTI

Several investigations of charged-particle reactions and scattering are summarized; information on the energy levels, Coulomb displacement energies, and radii of many nuclei is presented. Theoretical research on the optical model for nucleon scattering is outlined. Development of a windowless target chamber and of polarized proton and negative ion sources for the Van de Graaff accelerators is reported, together with the development of charged-particle identification systems, photoplate scanners, pulse divider circuits, a pair spectrometer, helium polarimeters, and target fabrication techniques. NSA

N69-15512# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
THE T EQUALS 2 MULTIPLET IN NUCLEI OF MASS 10
William D. Harrison Jan. 1968 7 p refs
(Contract AT(11-1)-1265)
(COO-1265-57) Avail: CFSTI

It is suggested that structure in the $^7Li(^4He,p)^{10}Be^*$ cross section may be due to a T = 2 state in ^{10}B at about 23.0 MeV excitation energy with a width of roughly 0.5 MeV. The corresponding mass of the unobserved nucleus ^{10}Li is estimated. Author (NSA)

N69-15538 Stanford Univ., Calif.
A COVARIANT THEORY OF THE DISINTEGRATION OF THE DEUTERON BY PHOTONS AND PIONS AT HIGH ENERGY
David John George (Ph.D. Thesis) 1967 109 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-6422

The disintegration of the deuteron, in the region of the first nucleon resonance, using the model suggested by Austern is investigated. The main impetus for the work was the new set of measurements of the asymmetry found in photodisintegration by Liu, which were of opposite sign to that predicted by conventional theory. It was also desired to see whether the model could explain the proton polarization in both photodisintegration and pion polarization. The method used was that of relativistic perturbation theory. The method is applicable in the resonance region. In this respect, as well as in some other areas, the calculation is similar to the Gourdin-Salin calculation of photoproduction. Most of the formalism used in this calculation has been developed by Vasavada and by Le Bellac et al. Dissert. Abstr.

N69-15547# Brookhaven National Lab., Upton, N. Y.
CONFIRMATION OF THE ξ (1815) AND EVIDENCE FOR A NEW ξ RESONANCE WITH MASS 2030 MeV
J. Alitti, E. Flaminio, W. Metzger, D. Radojicic, R. R. Rau, et al [1968] 8 p refs Presented at the 15th Intern. Conf. on High Energy Phys., Vienna, 28 Aug.-6 Sep. 1968
(BNL-12808; CONF-680809-27) Avail: CFSTI

Evidence for the existence of the ξ(1815) and for a new S = −2 baryon at a mass of 2030 MeV is obtained from a study of K⁻p interactions at 3.9, 4.6, and 5.0 BeV/c in the BNL 80-inch hydrogen bubble chamber. The strong configuration of the 1815 state strengthens previous speculation of the existence of an SU(3) octet having spin and parity $J^P = 3/2^-$. It is postulated that the new baryon belongs to an SU(3) octet with $J^P = 5/2^-$. NSA

N69-15548# Paris Univ., Orsay (France). Laboratoire de Physique Theorique et Hautes Energies.
REGGE BEHAVIOUR, KINEMATICAL SINGULARITIES AND FIXED POLES
S. Caser and J. L. Basdevant Jun. 1968 10 p refs
(LPTHE-TH-68/15) Avail: Issuing Activity

It is shown that the problems of daughter trajectories, conspiracy, and evasion are closely related to the existence of fixed poles in angular momentum. If fixed poles are discarded, then daughters, conspirators or vanishing residues, occur. This is obtained by assuming the scattering amplitude below threshold to be given by a dispersion integral on the Regge behavior above threshold. Author (NSA)

N69-15554# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SHELL MODEL CALCULATIONS FOR Bi-211
S. Gabrakov 1968 18 p refs
(JINR-E4-4029) Avail: CFSTI

Shell-model calculations of the energies of the first several levels in ^{211}Bi with spins 9/2 and 7/2 were made. The log ft-values for beta-decay to these levels and the probabilities for E2 and M1 transitions were also calculated. Author (NSA)

N69-15557*# Techtran Corp., Glen Burnie, Md.
STUDY OF ELASTIC AND THERMODYNAMIC CONTINUOUS MEDIA IN GENERAL RELATIVITY
Jean-Francois Bennoun 1968 82 p refs Transl. into ENGLISH from Ann. Inst. Henri Poincare (Paris), Sect. A, v. 3, no. 1, 1965 p 41-110
(Contract NASS-14826)
(NASA-CR-99135) Avail: CFSTI CSCL 20J

A relativistic theory of continuous media is formulated, due consideration being taken of the fact that, within the general theory of relativity, only the variation of physical quantities is operationally accessible. The structure of elastic media is discussed. Linking equations are established which describe the variation of states, and the problem of elasticity in general relativity is fully described. The study is then extended to relativistic thermodynamics, on the basis of a tensorial interpretation of the second principle. A continuity hypothesis related to the rate of change of the entropy density permits study of characteristic varieties and derivation of the general form of the relativistic equation for thermodynamic wave fronts. An application of the theory to the isotropic case is included. Author

N69-15561# Academy of Sciences (USSR), Moscow. Institut Atomnoi Energii.
DYNAMICAL TREATMENT OF THE X-RAY'S THERMAL DIFFUSE SCATTERING
A. M. Afanasev, Yu. Kagan, and F. N. Chukhovskii 1967 19 p refs
(IAE-1476) Avail: Issuing Activity

A dynamical theory of the thermal diffuse scattering of X-rays from thick crystals is developed which consistently takes into account the elastic Bragg scattering of both the incident and diffuse-scattered X-rays. Special attention is paid to analysis of the intensity distribution of the diffuse scattered waves near the Bragg peak. A special analysis is made of the influence of atomic vibration near the crystal surface on the angular intensity distribution of the scattered waves. Author (NSA)

N69-15562 Purdue Univ., Lafayette, Ind.
DEVELOPMENT AND DISCUSSION OF PUGH'S QUANTUM ELECTRODYNAMICS
Elsa Margaret Glover (Ph.D. Thesis) 1967 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-6305

One object of this thesis is to reorganize and extend the formulation of Pugh's quantum electrodynamics in order to obtain more simplicity, self-consistency and completeness than has heretofore been obtained. In this thesis the definition of the functional derivative is simplified and extended, a new derivation of the reduction equations is given, and the derivation of the theorem about the ignorable parts of the S matrix is written out. Another object of this thesis is to extend the application of the Pugh-type quantum electrodynamics to the calculation of the third-order vertex term. In the Pugh theory, the S matrix is found by adding an appropriate solution of a homogeneous functional differential equation to a particular solution of the full differential equation. This thesis also shows how the effects of an external electromagnetic field may be incorporated into the theory, and then uses an approximation of this external field theory to calculate the anomalous magnetic moment of the electron. Dissert. Abstr.

N69-15565 California Univ., Berkeley.
THE APPLICATION OF ANALYTICITY PROPERTIES TO THE NUMERICAL SOLUTION OF THE SCHROEDINGER AND BETHE-SALPETER EQUATIONS
Richard Webb Haymaker (Ph.D. Thesis) 1967 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-5734

A new method of calculating phase shifts from the Bethe-Salpeter equation is presented. The differential equation is solved below threshold using a variational method and then the scattering amplitude is continued to the physical scattering region using Padé approximants. The singularity structure of the Schrödinger and Bethe-Salpeter amplitudes in their offshell variables was studied to find the nearby singularities that could most strongly affect the continuation. A variational method of calculating Regge trajectories in potential theory is presented. The variational equations are derived in the bound state region and then continued directly to all values of angular momentum and energy. Dissert. Abstr.

N69-15570 Michigan Univ., Ann Arbor.
ELECTROMAGNETIC SCATTERING BY MOVING BODIES
Robert Charles Restrick, III (Ph.D. Thesis) 1967 105 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-7704

The purpose of this work is to investigate the nature of electromagnetic scattering by moving objects by means of the Theory of Relativity. The object is to learn what may be anticipated in the case of relativistic velocities and to justify the low velocity approximations now being used. Since the general problem allowing the scattering body to possess an arbitrary shape, motion, and material composition is highly difficult, this work considers two specific problems both involving perfect conductors scattering electromagnetic plane waves. The first problem considered is that of a uniformly moving sphere. The incident plane wave is allowed to have arbitrary polarization and direction of propagation relative to the motion of the sphere. The second problem considered is that of an infinite conducting sheet moving with an accelerated motion, called hyperbolic motion, which is the relativistically correct motion of a body being acted upon by a constant force. Dissert. Abstr.

N69-15572 Princeton Univ., N. J.
MEASUREMENTS OF NORMAL MOMENTUM ACCOMMODATION COEFFICIENTS FOR GAS-SOLID INTERACTIONS
Ronald Neil Kostoff (Ph.D. Thesis) 1967 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-8940

Normal momentum accommodation coefficients of argon, helium, oxygen and nitrogen on germanium, tantalum, and tungsten targets in the target temperature range of 425°K to 900°K are experimentally obtained. With some assumptions regarding the velocity distributions of the reflected molecules these coefficients are converted to energy accommodation coefficients, and are compared with past results. Dissert. Abstr.

N69-15575 Yale Univ., New Haven, Conn.
COLLECTIVE EXCITATIONS IN Pb-208, Pb-207, Pb-206 AND Bi-209 BY INELASTIC ELECTRON SCATTERING
James Francis Ziegler (Ph.D. Thesis) 14 Nov. 1968 217 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-6872

Collective excitations in Pb^{208}, Pb^{207}, Pb^{206} and Bi^{209} have been studied by inelastic electron scattering experiments at the Yale linear electron accelerator. Incident electron energies were from 28 to 83 MeV, and the scattering angles used were from 100° to 150°. This corresponds to a momentum transfer range from $0.26F^{-1}$ to $0.70F^{-1}$. Form factors were found for the 2.61 MeV (3 −) excited states in all four isotopes, and the 4.1 MeV (2 +) and 4.3 MeV (4 +) states in the Pb isotopes. The following states in Pb^{208} were also analyzed: 3.198 MeV, 5.25 MeV, 5.6 MeV, and 6.2 MeV; with the respective tentative assignments of spin and parity: 5 −, 3 −, (4 +), 3 −, 2 +|0 +). The data were analyzed using a distorted wave Born Approximation calculation. The nuclear excited state model of an irrotational incompressible vibrating liquid drop was found to be in excellent agreement with the shape of the 2.61 MeV (3 −) states in all the isotopes, and also with the 4.1 MeV (2 +) and 4.3 MeV (4 +) states in Pb^{208}. Dissert. Abstr.

N69-15576# California Univ., Berkeley. Lawrence Radiation Lab.
NUCLEAR STRUCTURE, FISSION, AND SUPERHEAVY ELEMENTS Lecture Notes
Sven Goesta Nilsson Aug. 1968 126 p refs
(Contract W-7405-ENG-48)
(UCRL-18355) Avail: CFSTI

The problem of nuclear stability is discussed in terms of the semiempirical mass formula. Spontaneous fission of superheavy elements is examined from the points of view of both statics and dynamics. NSA

N69-15578 Wisconsin Univ., Madison.
DEBYE-WALLER FACTOR, THERMAL DIFFUSE, AND MULTI-PHONON SCATTERING FOR LOW ENERGY ELECTRONS ON NICKEL
Robert Frederick Barnes (Ph.D. Thesis) 1967 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 67-16889

We have examined the diffraction of low energy electrons from the (111) surface of Ni. For the purpose of studying the surface lattice dynamics of the crystal, the Debye-Waller effect and the diffuse scattering were measured. In the Debye-Waller studies, the intensities of the Bragg peak scattering were found to have the usual exponential temperature dependence e^{-2M}, $2M = S^2 \langle u^2 \rangle$ where S is the diffraction vector and $\langle u^2 \rangle$ is the mean square vibrational amplitude. It is concluded that, in the direction normal to the surface, vibrational amplitudes at the surface are at least 3 times as large as the bulk vibrational amplitudes. Fitting the measured effective Debye temperatures to a kinematic analysis confirms this result. The diffuse scattering was measured. It is shown that the integrated intensity of the multi-phonon contribution to the scattering is given by $(e^{2M} - 2M - 1)$. It is suggested both by the experiments and by a detailed calculation of the two-phonon scattering that the multi-phonon scattering is very nearly uniformly distributed throughout the Brillouin zone. Dissert. Abstr.

N69-15596# Technische Hochschule Munchen (West Germany).
FLUORESCENCE STUDIES OF INTER AND INTRAMOLECULAR ENERGY TRANSFER DURING THE EXPOSURE OF ALIPHATIC AND AEROMATIC SYSTEMS TO IONIZING RADIATION [FLUORESZENZUNTERSUCHUNGEN ZUR INTER- UND INTRAMOLEKULAREN ENERGIEUEBERTRAGUNG BEI DER EINWIRKUNG IONISIERENDER STRAHLEN AUF SYSTEME AUS ALIPHATISCHEN UND AROMATISCHEN KOMPONENTEN]
Elmar Fick (Ph.D. Thesis) 1968 85 p refs In GERMAN
Avail: CFSTI

Luminous intensity spectra of 10^{-2} molecular solutions of n-alkylfluorenoles and of branched alkylfluorenoles with different molecular chain lengths were measured in hexane solution. The observed correlation between fluorescent intensity and the quantity of $-CH_2$ groups in branching chains showed that the intermolecular energy transfer occured in the alkyl groups. Evaluation of experimental data found a 0.65 probability for intermolecular energy transfer from the carbon atom to the carbon atom n-1. It was concluded that increased fluorescence was caused by electron transfers in primary products of ionizing radiation. Transl. by G.G.

N69-15604# Muenster Univ. (West Germany). Institut fur Theoretische Physik.
NUCLEAR LIE GROUPS AS SYMMETRIES OF A SCATTERING OPERATOR [NUKLEARE LIEGRUPPEN ALS SYMMETRIEN EINER STREUMATRIX]
C. v. Westenholz Apr. 1968 31 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-14) Avail: Issuing Activity

A very large class of infinite-dimensional Lie groups is considered in the framework of a phenomenological Lagrangian field theory in order to study symmetries of the scattering matrix. With appropriate restrictions about the mass-operator spectrum the following fundamental physical results are obtained: (1) the S-matrix can only be the trivial one; and (2) without further assumptions as for instance the existence of some finite-dimensional internal symmetry-subgroup of the given nuclear Lie group only a trivial coupling between internal and space-time symmetry can be obtained. Author (NSA)

N69-15605# Brookhaven National Lab., Upton, N. Y.
ASYMPTOTIC ENERGIES
S. J. Lindenbaum Aug. 1968 49 p refs Presented at the Intern. Symp. on Contemp. Phys., Trieste, Italy, Jun. 1968 Supported in part by AEC
(BNL-12811; CONF-680629-1) Avail: CFSTI

The experimental determination of forward scattering amplitudes at high energies and dispersion relation calculations are first discussed. The question of sensitivity of the calculations to asymptotic behavior of the total cross sections, and the demonstration of the validity of pion–nucleon forward dispersion relations reasonably independent of this behavior, are considered. The relations are then used to predict the asymptotic behavior of forward scattering amplitudes. NSA

N69-15613 California Univ., Irvine.
AN ABSTRACTION OF HYDROGEN ATOMS BY ENERGETIC TRITIUM ATOMS FROM NUCLEAR RECOIL
Enzo Tachikawa (Ph.D. Thesis) 1967 283 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 68-8285

Tritium atoms from nuclear recoil were allowed to react with various hydrocarbons or halocarbons in the presence of a large amount of moderator, perfluorocyclobutene. The energy loss process of the recoil atom are primarily controlled by the collisions with perfluorocyclobutene molecules, and thus the energetic tritium atom flux is reasonably similar in each of the systems, permitting a direct comparison of the HT yield from various R–H bond types. Yields of HT thus obtained from various reactants showed a good correlation with the dissociation energy of the C–H bond involved, with a higher yield from the weaker bonds. Similar correlation curves have also been obtained using different moderators, including perfluorocyclobutadiene, perfluoropropylene, argon and nitrogen. Using the established correlation between HT yield and C–H bond strength, estimates of the C–H bond strength in halomethanes and some ethylenic compounds have been obtained. Dissert. Abstr.

N69-15618# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
EXACT SOLUTION OF A ONE-DIMENSIONAL ELECTRICAL TRANSPORT PROBLEM WITH ELASTIC AND INELASTIC SCATTERING
Richard A. Gerwin Nov. 1968 50 p refs
(Di-82-0774) Avail: Issuing Activity

A gas of charged particles making both elastic and inelastic collisions is assumed to be in a uniform steady state in a uniform steady electric field. Supposing that the gas obeys a one dimensional Boltzmann equation, this equation is solved exactly for the case of energy independent elastic and inelastic mean free paths, together with the assumption of isotropic scattering. The gas drift velocity and gas temperature are then obtained from the velocity distribution, and their dependences on electric field strength are displayed. The results are in good qualitative agreement with other theories and with experiments on N-type germanium at liquid nitrogen temperature. Author

N69-15619# California Univ., Berkeley. Lawrence Radiation Lab.
LECTURES ON EFFECTIVE INTERACTIONS, EFFECTIVE OPERATORS AND CLOSED SHELL NUCLEI
Larry Zamick 1 Aug. 1968 37 p refs
(Contract W-7405-ENG-48)
(UCRL-18445) Avail: CFSTI

Nucleon interactions outside of a closed shell are discussed. This type of interaction is described by an effective interaction using operators developed from the effective charge concept. The importance of core polarization and the limitations and justification of the effective interaction and effective operators are discussed. NSA

N69-15639# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.
PARTICLE-HOLE CONFIGURATIONS OF EVEN-EVEN NUCLEI OF Ni-60, Zn-64, Zn-66
V. V. Okorokov, V. M. Serezhin, V. A. Smotryaev, D. L. Tolchenkov, I. C. Trostin et al 1968 18 p refs In RUSSIAN; ENGLISH summary
(ITEF-596) Avail: CFSTI

The highly excited states of ^{60}Ni, ^{64}Zn, and ^{66}Zn were investigated using the reactions ^{59}Co(d,n)^{60}Ni, ^{63}Cu(d,n)^{64}Zn, and ^{65}Cu(d,n)^{66}Zn. The cross sections of the (d,n) reactions were compared with distorted-wave calculations. Particle-hole configurations were attributed to the states in ^{60}Ni, ^{64}Zn, and ^{66}Zn. NSA

N69-15641 Maryland Univ., College Park.
ANALYSIS OF THE CASCADE FINAL STATES FROM 4.25 BeV/c NEGATIVE KAON INTERACTIONS
Gilbert Wolsky (Ph.D. Thesis) 1967 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-7045

The reactions $K^- + p \rightarrow \Xi + K + m\pi$ have been analyzed at an incident momentum of 4.25 BeV/c. The experiment was primarily concerned with the study of the strangeness −2 baryon resonances. The data in most cases was consistent with the results obtained at lower energies. A higher mass value was found for the $\Xi^*(1930)$. Evidence was also found for the possible existence of a new $T = 3/2$ Ξ^* resonance at mass value of 2225 MeV. There was also strong K^* production, the $K^*(890)$ being the only resonance that is produced appreciably in a quasi two-body final state. The two-body and quasi two-body production processes appear to be dominated by baryon exchange. The results for the final state Ξ^-K^+ were compared to the predictions of the model of Ebel and James. The model was found to be inadequate to describe fully this final state. Dissert. Abstr.

N69-15663 California Univ., Berkeley.
NEGATIVE PION PLUS He 4 INELASTIC AND CAPTURE REACTIONS LEADING TO EXCITED AND MULTI-NEUTRON FINAL STATES
Leon Kaufman (Ph.D. Thesis) 1967 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-5745

A beam of 140 ± 0.5 – MeV π^- was produced at the Berkeley 184-inch cyclotron and used to study the final-state interactions of three and four neutrons, and to look for excited levels of the α particle. Only one such level is found, with an excitation energy of 32 MeV and an intrinsic width smaller than our 1–MeV resolution. We find that our data on the four-neutron final state is best fit by considering two neutrons interacting through a $^1S_0$ potential, and the two other ones as spectators. We find too that deuteron production is down by a factor of $\sim 10^3$ from proton production, and that the proton spectrum shows a stronger than expected interaction between the three neutrons in the final state. Dissert. Abstr.

N69-15665 Johns Hopkins Univ., Baltimore, Md.
ASSOCIATED PRODUCTION IN NEGATIVE PION PROTON INTERACTIONS AT 5.5 GeV/c
Edward Joel Moses (Ph.D. Thesis) 1967 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-6570

A study has been made of states with two strange particles arising from interactions of 5.5 GeV/c negative pions with protons. The experiment was performed at the Brookhaven National Laboratory using the 80" Liquid Hydrogen Bubble Chamber. Events with zero, two, and four charged prongs were included and cross-sections for the final states available in these channels have been measured. The only strong resonance production observed was that of K^0

(890) but limited statistics precluded ruling out production of other resonant states. Weak evidence was seen in K_1K_1 spectra for the recently reported 1050 MeV state of positive charge conjugation, but there is no evidence in K_1K_2 states for the negative charge conjugation meson. Some indications were found suggesting that low multiplicity final states tend to be produced peripherally. One exception was the final state $\Sigma^- K^+$, which exhibits small momentum transfers from meson to baryon. Dissert. Abstr.

N69-15666 Indiana Univ., Bloomington.
CROSS-SECTION ANGULAR DISTRIBUTIONS FOR Ca 40 (d,d) AND (d,p) REACTIONS, AND PROTON POLARIZATION NEAR A J-DEPENDENT MINIMUM
Charles Carlton Foster (Ph.D. Thesis) 1967 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-7213

Present theories of the mechanism of the deuteron stripping reaction are unable to account for certain crucial observed features, such as the dependence of the cross-section angular distribution of the outgoing protons on the total angular momentum transfer (J-dependence) and the spin polarization of these protons. To provide additional information for theoretical comparisons the following work has been carried out: (1) Differential cross-section angular distributions have been measured at 11-MeV incident deuteron energy for the elastic scattering of deuterons from calcium, and for the Ca^{40}-(d,p) reactions exciting the ground, 1.95-MeV, 2.47-MeV and 3.95-MeV states of Ca^{41}. (2) Proton polarization measurements have been obtained for the Ca^{40}(d,p) reaction exciting the 3.95-MeV state of Ca^{41}. Results for these polarization measurements are 0.128 ± 0.039, +0.081 ± 0.046 and +0.151 ± 0.041 respectively. Dissert. Abstr.

N69-15705 Stanford Univ., Calif.
HIGH DENSITY CORRECTIONS FOR NEUTRON SCATTERING FROM FLUIDS
David Lawrence Feinstein (Ph.D. Thesis) 1967 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-6415

The differential cross section for scattering of neutrons by a system of identical nuclei with zero spin can be written as a product of two terms, one of which depends only on the properties of the scattering system. This term, "the scattering law," which is the time-space transform of the pair distribution function G, is investigated for gases and liquids. It is shown that the convolution approximation ignores perturbations caused by the test particle for $t > 0$. For a dilute gas, a normal mode expension of the Boltzmann equation is made to estimate the size of the collective effects contribution to the scattering law. It is found that for small energy and momentum transfers, the collective effects contribution dominates the solution. The hydrodynamic and convolution approximations are compared to experimental results for liquid sodium. Dissert. Abstr.

N69-15710 Cornell Univ., Ithaca, N. Y.
AN INVESTIGATION OF THE ACCURACY OF THE TOMONAGA INTERMEDIATE COUPLING APPROXIMATION
Joel Lawrence Horowitz (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-4673

The Tomonaga intermediate coupling approximation and a two-wave-function generalization of it are applied to the system consisting of charged, scalar mesons interacting with a static-source nucleon. The generalization allows mesons in the nucleon ground state to occupy either of two states in momentum space. Expressions are obtained for the ground-state wave functions and energy, and for the differential cross section for the elastic scattering of positive mesons by protons. A comparison of the results of the one- and two-wave-function approximations indicates that the Tomonaga approximation is able to accurately predict static properties of the ground state, such as its energy, but not scattering cross sections. A non-Tomonaga single-wave-function approximation for the ground state is derived from the two-wave function Tomonaga approximation. The scattering cross sections obtained with the non-Tomonaga approximation agree well with those obtained using the two-wave-function Tomonaga approximation. Dissert. Abstr.

N69-15711 Georgia Univ., Athens.
DIFFERENTIAL CROSS SECTIONS FOR A DIRECT NUCLEAR REACTION LEADING TO A MULTI-PARTICLE FINAL STATE
Billy Joe Henderson (Ph.D. Thesis) 1967 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-5049

Angular distributions for fixed values of the proton momentum, and proton momentum distributions for fixed angles are calculated for the reaction ^6Li (^3He,pα)^4He. The possibility of proton exchange between the incident ^3He and the proton in the deuteron is included. In order to assess the sensitivity of the calculation with respect to the wave functions, two different wave functions are used for ^3He. Zero range, point-nucleus, and finite range approximations for some of the potentials are compared. Parametric studies are done with respect to the cutoff radius, the proton energy, and constants which appear in the wave functions. The calculation assumed PWBA stripping theory, including nuclear recoil but neglecting spin. Dissert. Abstr.

N69-15727# Wyoming Univ., Laramie.
NUCLEAR PHYSICS STUDIES USING NUCLEAR EMULSIONS Technical Progress Report, 1968
1 Aug. 1968 38 p refs
(Contract AT(11-1)-1549)
(COO-1549-10) Avail: CFSTI

Neutron energy spectra and angular distributions from the reactions of 26-MeV protons with ^{63}Cu and ^{60}Ni were measured. The efficiency of a double scintillator neutron time-of-flight spectrometer was investigated; a method for achieving γ background suppression in proton-recoil spectrometers was developed. Computer simulation studies of the effects of various parameters upon the efficiency and resolution of the neutron time-of-flight spectrometer were initiated; the response of the organic scintillator to fast neutrons was studied in detail. An attempt to observe ^{64}Ge through the ^{64}Zn(^3He,3n)^{64}Ge reaction was made. The reaction of 160-MeV ^{16}O ions with ^{58}Ni was investigated; experimental data were analyzed in terms of the transfer of an α particle or of a ^{12}C nucleus and in terms of the complete fusion of ^{16}O with the target nucleus. NSA

N69-15729# International Centre for Theoretical Physics, Trieste (Italy).
KAON MASS DIFFERENCE, K_A AND KAON DECAYS
K. Tanaka Aug. 1968 15 p refs Supported in part by the A.E.C.
(IC-68-81) Avail: CFSTI

In a model in which the intermediate states of K and K_A are considered in virtual photon kaon scattering, it is shown that the nature and sign of the electromagnetic kaon mass difference $\Delta m_K = m_{K^+} - m_{K^0}$ depend on a parameter, δ_K, that can be obtained from the decay rates $K_A \to \pi^0\pi^+$ and $K^+ \to \pi^+$. For favorable values of δ_K that yield the experimental decay rates, the kaon mass difference is logarithmically divergent and can have the correct sign ($\Delta m_K < 0$), provided the cutoff is large enough. On the other hand, if the Δm_K is required to be convergent, one obtains $\Delta m_K > 0$ and a weaker form of Weinberg's second sum rule in SU(3)×SU(3). ESRO

N69-15730# International Centre for Theoretical Physics, Trieste (Italy).
QUANTITATIVE HIGH-ENERGY πp SCATTERING PREDICTIONS FROM LOW-ENERGY PHASE SHIFTS
C. Ferro Fontan, R. Odorico (Trieste Univ.), and L. Masperi (CNEA) Sep. 1968 17 p refs Submitted for publication
(IC-68-90) Avail: CFSTI

Using continuous moment sum rules applied to Berkeley, CERN and Saclay phase shifts, a full prediction is given in good agreement with experimental data, of high-energy differential cross-sections and polarizations in $\pi^- p \to \pi^0 n$ and $\pi^+ p$ elastic scattering. Author (ESRO)

N69-15736# Oak Ridge National Lab., Tenn.
FITS TO SINGLE PARTICLE WAVE FUNCTIONS USING WOODS-SAXON EIGENFUNCTIONS: THE CODE LINDA
F. S. Chwieroth 4 Sep. 1968 15 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2342) Avail: CFSTI

A FORTRAN code has been written for the IBM-360 which optimizes the agreement between a set of input single particle wave functions and/or binding energies and a corresponding set computed using a Woods-Saxon potential well by varying the parameters of the potential well. A number of options allow this to be done in various ways. Spin-orbit coupling and nonlocality effects may be included. Author (NSA)

N69-15742*# General Motors Corp., Santa Barbara, Calif. AC Electronics-Defense Research Labs.
CROSS SECTIONS FOR IONIZATION IN COLLISIONS BETWEEN EXCITED NITROGEN MOLECULES AND ARGON ATOMS, OXYGEN MOLECULES, AND NITRIC OXIDE MOLECULES
Nyle G. Utterback and Bert Van Zyl Dec. 1968 26 p refs
(Contract NAS2-4924)
(NASA-CR-73287; TR-68-65) Avail: CFSTI CSCL 20H

A molecular beam of N_2 in the $A^3\Sigma_u^+$ state has been used to bombard target molecules of Ar, O_2, and NO. The ionization cross sections have been determined for these collisions at kinetic energies from a few eV above the energy threshold to 100 eV above threshold in the center-of-mass coordinate system. Preliminary measurements of the cross section involving CO target molecules have also been made. A comparison of all these cross-section values with those obtained using ground-state N_2 molecules indicates that internal electronic energy is roughly equivalent to an equal amount of kinetic energy in producing ionization by a given ionizing process. However, certain selection rules appear to limit the ionizing processes which can occur, thereby decreasing the total cross section in some cases at a given kinetic-plus-internal energy. Author

N69-15743# International Centre for Theoretical Physics, Trieste (Italy).
IMPROVED INVERSE GAP EQUATION AND QUASIPARTICLE THEORIES OF ODD AND EVEN TIN ISOTOPES
R. Aizetta (Trieste Univ.), Y. K. Gambhir, M. Gmitro, A. Rimini (Trieste Univ.), J. Sawicki et al Sep. 1968 39 p ref Supported in part by the Ist. Nazl. di Fis. Nucl. Submitted for publication
(IC-68-83) Avail: CFSTI

The nuclear structure properties of the odd and even tin isotopes are studied, making use of an improved inverse gap equation (IGE) method and the quasiparticle theories. The two-body nuclear force assumed is a realistic potential (or reaction matrix) renormalized for the core polarization. Two cases are considered: a) the potential of Tabakin, and b) the reaction matrix of Yale-Shakin. While most types of levels are obtained in good agreement with experiment, others sharply disagree with the data. Spectroscopic factors for the one- and two-nucleon transfer reactions are presented and discussed. A warning is given against too much optimism about the indiscriminate applicability of the IGE method. Possible explanations for the difficulties of the method are discussed. Author (ESRO)

N69-15746# International Centre for Theoretical Physics, Trieste (Italy).
AN ALGEBRAIC DESCRIPTION OF BOUND STATES AND RESONANCES
N. Tarimer (Cekmece Nucl. Res. Center) Sep. 1968 20 p refs Submitted for publication
(IC-68-93) Avail: CFSTI

A particular generalization of almost periodic function theory can be used to obtain an algebraic description of bound states and resonances. Classical almost periodic function theory is applied to obtain a group theoretical criterion for the description of bound states. Next, a new mathematical concept, named 'damped almost periodic function', is defined and its elementary properties are investigated. Finally, these ideas are applied to potential theory with Yukawa-type coupling for the description of resonances in an appropriately defined distribution space. Author (ESRO)

N69-15755# International Centre for Theoretical Physics, Trieste (Italy).
IMPLICATIONS OF THE O(4,2) MODEL OF STRONG INTERACTIONS FOR REGGE POLE AND HIGH-ENERGY PHENOMENOLOGY
A. O. Barut Sep. 1968 26 p refs Presented at the Symp. on Hadron Spectry., Keszthely, Hung., Sep. 1968
(IC-68-88) Avail: CFSTI

Linear Regge trajectories, secondary trajectories, form factors and their relation to high-energy hadron scattering are consequences of the O(4,2) model of strong interactions. The O(4), O(2,1) and the two distinct SL(2,C) classifications of trajectories used at present, as well as the exchange degenerate trajectories, are all given by the subalgebras of the O(4,2). Author (ESRO)

N69-15766 Stanford Univ., Calif.
PROTON POLARIZATION IN THE REACTION C 12(d,p)C 13 (3.09 MeV)
Nicholas Charles Herbert (Ph.D. Thesis) 1967 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-6428

The polarization of protons from the reaction $C^{12}(d,p)C^{13*}$ (3.09 MeV)(Q = −0.36 MeV) was measured at three bombarding energies (E_d = 2.8, 3.0 and 3.2 MeV) at angles between 40° and 120°. The reaction $Li^7(p,He^4)He^4$ was used as a polarization analyzer. The angular distribution of polarization was roughly similar at each bombarding energy. Polarizations as high as 30% were observed. These results were compared to the polarization of protons of equivalent energies scattered elastically from C^{12}. This comparison is motivated by a recent direct interaction theory advanced by C. A. Pearson and M. Coz. The observed agreement suggests that proton-core elastic scattering may be an important process in producing the polarization observed in particular (d,p) reactions. Dissert. Abstr.

N69-15769# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
ELECTROMAGNETIC CORRECTIONS TO K YIELDS 3 PI RATES
A. Neveu and J. Scherk [1968] 7 p refs
(TH-68/17) Avail: CFSTI

The electromagnetic corrections are calculated to $K \to 3\pi$ rates from a simple model, and their consequences on the predictions of various selection rules in non-leptonic decays of kaons. Comparison is made with experimental data. Author (NSA)

N69-15772# International Centre for Theoretical Physics, Trieste (Italy).
IRREDUCIBILITY OF THE LADDER REPRESENTATIONS OF U(2,2) WHEN RESTRICTED TO ITS POINCARE SUBGROUP
G. Mack and I. Todorov Jul. 1968 24 p refs In GERMAN
(IC-68/86) Avail: CFSTI

It is shown that the most degenerate discrete series of unitary irreducible representations of U(2,2), the so-called ladder representations, remain irreducible when restricted to representations of the Poincaré subgroup ISL(2,C). They correspond to representations of this subgroup with mass zero and arbitrary integer or half-integer spin j and helicity $\lambda = \pm j$. The basis vectors of the canonical basis are calculated as functions of a light-like 4-vector, which is formed by the simultaneous eigenvalues of the generators of the subgroup of translations. Author (NSA)

N69-15780# Argonne National Lab., Ill.
BISON: A FORTRAN COMPUTER SYSTEM FOR THE CALCULATION OF ANALYTIC SELF-CONSISTENT-FIELD WAVEFUNCTIONS, PROPERTIES, AND CHARGE DENSITIES FOR DIATOMIC MOLECULES. PART 1: USER'S MANUAL AND GENERAL PROGRAM DESCRIPTION
Arnold C. Wahl, P. J. Bertoncini, K. Kaiser, and Robert H. Land Jan. 1968 125 p refs
(Contract W-31-109-ENG-38)
(ANL-7271) Avail: CFSTI

Techniques and a new computer program developed by the authors for obtaining self-consistent-field (SCF) wave funtions and properties [very close to the Hartree–Fock (HF) limit] via the Roothaen Expansion Method for heteropolar or homopolar diatomic molecules containing atoms from rows 1 through 5 of the periodic table are discussed. The computer program, which is written entirely in FORTRAN, evaluates all necessary integrals, performs the SCF procedure and then computes charge-density contours and a variety of molecular properties from the resulting SCF wave function. The limitations on the quantum numbers of the Slater-type orbital (STO) basis are $1 \leq n \leq 8$; $0 \leq l \leq n-1$; $-l \leq m \leq l$; a maximum of 1 1/2 million supermatrix elements are permitted which allows accurate SCF calculations on very large diatomic systems. Typical results of recent extended basis-set calculations for the alkali halide NaCl, which illustrate program usage, are presented. Author (NSA)

N69-15781# Israel Atomic Energy Commission, Tel-Aviv.
COMPUTER PROGRAM FOR THE LEAST SQUARES ANALYSIS OF GAMMA RAY SPECTRA INCLUDING A CORRECTION FOR SHORT-LIVED RADIONUCLIDES
A. Gavron Jun. 1968 24 p refs
(IA-1165) Avail: Issuing Activity

A computer program for the least squares analysis of gamma ray spectra is described. The program includes automatic gain and threshold shifting, and a correction for short-lived radionuclide decay. Author (NSA)

N69-15786# International Centre for Theoretical Physics, Trieste (Italy).
FUNDAMENTAL THEORY OF MATTER: A SURVEY OF RESULTS AND METHODS
Abdus Salam Sep. 1968 79 p refs Presented at the Intern. Symp. on Contemp. Phys., Jun. 1968 Submitted for publication
(IC-68-87) Avail: CFSTI

A review is given of the present state of quantum mechanics, relativistic quantum electrodynamics in terms of field theory and analytic S-matrix method pointing to future developments. ESRO

N69-15793# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
REPORTS ON SECTIONS EFFECTED BY THE ISOMERIC PAIR Y87m/Y-87) FORMED IN THE NUCLEAR REACTION Zr-90 (d, α n) [RELACIONES DE SECCIONES EFICACES PARA EL PAR ISOMERICO Y-87m/Y-87 FORMADO EN LA REACCION NUCLEAR Zr-90 (d, α n)]
A. Fanchiotti (La Plata Univ.), O. Andrade (La Plata Univ.), A. Mocoroa (La Plata Univ.), and S. J. Nassiff 1968 10 p refs In SPANISH
(CNEA-214) Avail: CFSTI

The relation of sections effected by an isomeric yttrium pair (87m and 87) formed in the nuclear reactions of zirconium (d, α n) as a function of charged particle energy was experimentally determined. It was found that the reactions increased when the deuteron energy was varied between thresholds and 27.00 MeV. Author

N69-15812# California Univ., Livermore. Lawrence Radiation Lab.
FAST THOMAS-FERMI-LIKE EQUATION OF STATE
J. W. Zink 15 Aug. 1968 14 p refs
(Contract W-7405-eng-48)
(UCID-15352) Avail: CFSTI

A method of obtaining a Thomas-Fermi-like equation of state is described. The method requires a minimum of computing time and can consequently be used directly in hydro codes. Author (NSA)

N69-15816# International Centre for Theoretical Physics, Trieste (Italy).
EVIDENCE FOR B–ρ' CONSPIRACY FROM PHOTOPRODUCTION SUM RULES
P. Di Vecchia (CNEN), F. Dragon (CNEN), C. Ferro Fontan, and R. Odorico (Trieste Univ.) Sep. 1968 11 p refs
(Contract F6-1052-67-C-0084)
(IC-68-91) Avail: CFSTI

The B–ρ' conspiracy in π photoproduction is established using continuous moment sum rules. Dynamical zeros near t=0, which depress the contribution to forward cross-sections, are found for both poles. B (1220) and ρ_v (1660) mesons are sitting on the trajectories found. Author (ESRO)

N69-15821# Oak Ridge National Lab., Tenn.
REPORT TO THE AEC NUCLEAR CROSS SECTION ADVISORY COMMITTEE
P. H. Stelson Sep. 1968 24 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-2364) Avail: CFSTI

Several investigations of charged-particle reactions and scattering and of neutron reactions and scattering are summarized. Information on the energy levels and neutron resonance parameters of some isotopes is presented. In addition, the interactions of heavy ions with gases and solids, neutron spectra in the upper atmosphere, photonuclear cascades, neutron fluxes from reactions of GeV protons, and the Moessbauer effect for ^{61}Ni in Cu–Ni alloys were investigated. A test of time reversal invariance by spin-flip in proton elastic scattering by ^{13}C is reported, as are developments in the preparation of C foils, ^{152}Eu targets, and ^{239}Pu samples. NSA

N69-15827# International Centre for Theoretical Physics, Trieste (Italy).
DIFFRACTION MODEL ANALYSIS OF DEUTERON AND He 3 SCATTERING
M. H. Simbel (Cairo Univ.) and A. Y. Abul-Magd Sep. 1968 13 p refs Submitted for publication
(IC-68-84) Avail: CFSTI

Diffraction model analyses are reported for the elastic scattering of deuterons and ^{3}He-particles from different nuclei. The quantitative agreement for the scattering of deuterons is significantly poorer than that found in the case of alpha-particle scattering, especially for the lighter nuclei. The agreement is much better in the case of ^{3}He scattering, where the parameters are rather stable against the variation of the mass of the target. The reflection and refraction are found to play a minor role in the latter case, indicating that the absorption is the predominant mechanism in ^{3}He scattering.
Author (ESRO)

N69-15838# California Univ., Irvine.
RESEARCH PROGRAM IN NEUTRINO PHYSICS, COSMIC RAYS AND ELEMENTARY PARTICLES Technical Report, 1 Oct. 1967–30 Sep. 1968
F. Reines, Marshall F. Crouch, Robert M. Woods, Jr., William R. Kropp, Michael K. Moe et al Jul. 1968 30 p refs
(Contract AT(11-1)-GEN-10)
(UCI-10P19-7) Avail: CFSTI

A new upper limit has been placed on the neutral lepton current via the reaction $\bar{\nu}_e + d \rightarrow n + p + \bar{\nu}_e$ for which the cross-section is now $< 3 \times 10^{-42}$ cm^2/fission $\bar{\nu}_e$. This constitutes an improvement by a factor of 100 from the previous limit. Muon decays have been observed at moderate and at great depths underground enabling two inferences to be drawn. (1) The results at moderate depths provide independent evidence that the very energetic penetrating component is due to muons and gives a new tool for the study of muon spectra. (2) The results at great depths allow the effective atmospheric neutrino spectra to be inferred as in the general vicinity of 10 GeV. Further study of the background in the solar neutrino scintillation detection has reinforced the earlier suspicion that spontaneous fission gives rise to gamma-rays with energies up to ~20 MeV. This is considerably higher than the ≈7 MeV observed by other groups with less sensitive techniques.
Author (NSA)

N69-15886# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
FACTORIZATION AND CONSTRAINTS IN REGGE-POLE THEORY
A. Capella, A. P. Contogouris, and J. Tran Thanh Van May 1968 13 p refs
(LPTHE-TH-68/14) Avail: CFSTI

Nongroup-theoretical methods are used to determine the behavior at momentum transfer $t^{1/2}$ of the Regge residue functions of the t-channel reaction. The solution presented is minimal in the sense that for a trajectory of known quantum numbers it gives the most singular behavior compatible with analyticity requirements and the factorization theorem. The solution is used to show that in certain cases all the kinematical constraints at $t = 0$ to all orders can be satisfied to all orders in $s = (p_1 + p_2)^2$. In particular, for a situation which corresponds to the group-theoretical class 3, parity doubling is deduced.
NSA

N69-15887# Kobe Univ. (Japan). Faculty of Liberal Arts.
FOLDY TRANSFORMATION IN THE PION-NUCLEUS INTERACTION
Il-Tong Cheon [1968] 17 p refs Submitted for publication
Avail: CFSTI

The expansion of the pion-nucleon interaction is derived with respect to the ratio of the coupling constant to the nucleon mass where the coefficients bear a simple relation to each other
Author

N69-15873# International Centre for Theoretical Physics, Trieste (Italy).
SELF-CONSISTENCY CONDITIONS FOR AN INELASTIC AMPLITUDE AND FOR COUPLING CONSTANTS
A. O. Barut and B. C. Unal Oct. 1968 10 p refs Submitted for publication
(IC-68-94) Avail: CFSTI

By an S-Matrix method, the 'self consistency' (gage) condition of pion-nucleon collisions is derived, which are considerably modified as compared to elastic pion-nucleon scattering. They lead to consistency relations between the coupling constants and form factors of resonant states.
ESRO

N69-15874# International Centre for Theoretical Physics, Trieste (Italy).
ON THE TRANSFORMATION FROM O(3) TO O(2,1) BASES IN SL(2,C)
D. A. Akyeampong, J. F. Boyce, and M. A. Rashid Jul. 1967 14 p refs Submitted for publication
(IC-67-81) Avail: CFSTI

The overlap function from O(3) to O(2,1) basis vectors for unitary representations of SL(2,C) group obtained originally by Sciarrino and Toller is recast as a finite series of products of Γ functions. This has the advantage of simplifying explicit calculations of the overlap function for cases of practical interest. We illustrate the use of the formula for the case of forward NN scattering.
Author (ESRO)

N69-15883# Stanford Univ., Calif. High Energy Physics Lab.
A TEST OF TIME REVERSAL INVARIANCE IN ELASTIC ELECTRON SCATTERING FROM THE DEUTERON
R. Prepost (Wisconsin Univ., Madison), R. M. Simonds, and B. H. Wiik Aug. 1968 13 p refs Submitted for publication Prepared in cooperation with Wisconsin Univ., Madison
(Contract Nonr-225(67); AT(11-1)-881)
(AD-678327; SU-HEPL-574; COO-881-193) Avail: CFSTI CSCL 20/8

A test of time reversal invariance for an electromagnetic interaction at high momentum transfer were performed by measuring the recoil deuteron vector polarization for the elastic scattering of electrons from an unpolarized deuteron target for an incident electron energy of 1 GeV and a recoil deuteron 4-momentum of q = 721 MeV/c. The value obtained for the vector polarization is P = 0.075 plus or minus 0.088 showing no significant T violation.
Author (TAB)

N69-15899*# AZTEC School of Languages, Inc., Acton, Mass.
ELASTIC PROTON HELIUM 4 BACKWARD SCATTERING AT 665 MeV PROTON ENERGY [UPRUGOYE PROTON HELIUM 4 RASSEYANIYE NAZAD PRI ENERGII PROTONOV 665 MeV]
V. I. Kamarov et al Washington NASA Jan. 1969 12 p refs Transl. into ENGLISH from Russian Report JINR-PI-3720
(Contract NASw-1692)
(NASA-TT-F-12086; JINR-PI-3720) Avail: CFSTI CSCL 20H

The differential cross section of 665 MeV proton elastic scattering by He^4 nuclei at an angle of 169° (c.m.s.) was measured by the scintillation counter method. The obtained value of $(1.2 \pm 0.3) \cdot 10^{-31}$ cm^2 · ster.$^{-1}$ at 9.5 fermi^{-1} is compared with a theoretical estimation of the probability of such scattering based on the idea of fluctuations in the density of nuclear matter.
Author

N69-15924# Aktiebolaget Atomenergi, Stockholm (Sweden).
NEUTRON ELASTIC SCATTERING CROSS SECTIONS OF IRON AND ZINC IN THE ENERGY 2.5 TO 8.1 MeV
B. Holmquist, S. G. Johansson, A. Kiss, G. Lodin, and T. Wielding Oct. 1968 30 p refs
(AE-337) Avail: CFSTI

Angular distributions were measured for the elastic scattering of neutrons from iron at five energies between 3.0 and 8.1 MeV and from zinc at eight energies between 2.5 and 8.1 MeV.

Time-of-flight technique was used. Corrections for neutron flux attenuation, multiple elastic scattering, and the finite geometry of the source-sample-detector system were made by using a Monte Carlo program. An optical model potential with Saxon-Woods form factors was used to fit theoretical angular distributions to the experimental ones. The parameter values giving the best fits to the experimental distributions were calculated by a computer.
Author (ESRO)

N69-15929# Brookhaven National Lab., Upton, N. Y.
RECENT EVIDENCE FOR A CHARGED NONSTRANGE MESON AT APPROXIMATELY 975 MeV PRODUCED IN NEGATIVE KAON PROTON INTERACTIONS AT 4.6 GeV/C
V. Barnes, P. Dornan, P. Guidoni, N. Samios, and M. Goldberg (Syracuse Univ., N. Y.) [1968] 7 p Presented at 14th Intern. Conf. on High Energy Phys. Vienna, 28 Aug.-5 Sep. 1968 Sponsored by AEC
(BNL-12803; CONF-680809-28) Avail: CFSTI

Preliminary results are reported of a study of K⁻p interactions at 4.6 GeV/c in the BNL 80-inch hydrogen bubble chamber. A significant enhancement was observed in the (π^-, M) effective mass distribution at 975 MeV for 2736 $K^- + p \rightarrow \Lambda^0 + \pi^+ + \pi^- +$ (neutrals = M) events. Possible decay modes of the X⁻ via the (π^- + neutrals) channel are examined.
NSA

N69-15930# Oak Ridge National Lab., Tenn.
APPLICATION OF NUCLEAR PHYSICS IN RELATED SCIENTIFIC FIELDS AND THE NATIONAL ECONOMY
A. I. Leipunskii May 1968 17 p Transl. into ENGLISH from Usp. Fiz. Nauk (Moscow), no. 95, May 1968 p 15-23 Sponsored by AEC
(ORNL-TR-1990) Avail: CFSTI

The development of nuclear physics and atomic energy for peaceful purposes in the Soviet Union is described. Application of the science to related fields is described and forecasts are made for the future. The possibilities of using atomic energy for space travel, large scale electrical power, and transportation are discussed.
NSA

N69-15951# Commissariat a l'Energie Atomique, Saclay (France). Section de Physique et d'Experimentation.
MEASUREMENT OF FLUX INTENSITY AND EPITHERMAL FLUENCE IN THE NEIGHBORHOOD OF 1 keV (TWO P-Cu DETECTOR METHOD) [MESURE DE L'INTENSITE DU FLUX ET DE LA FLUENCE EPITHERMIQUE AU VOISINAGE DU KEV (METHODE DE COMPENSATION A DEUX DETECTEURS P-CU)]
Gerard Farny Apr. 1968 34 p refs In FRENCH
(CEA-R-3441; DPE/SPE/67/558) Avail: CFSTI

The measurement of epithermal intensity in the 0.5 to a few tens of eV using conventional resonating detectors: Pu, Lu, In, Au, etc, is carried out in an energy range which is of little interest from the point of view of radiation damage studies. It is for this reason that we have attempted to measure the flux per unit of lethargy in the region of one keV independently of any consideration concerning the shape of the spectrum, as long as it is declining. This method can be summarized as a subtraction: from the total activity of a detector resonating at one keV (copper) is subtracted the activity which does not correspond to its resonances using a second detector whose cross-section is in 1/v (phosphorus). By using B_4C as screen it is possible to have a cut-off at about 100 eV and thus improve the accuracy. A calibration using cobalt allows a direct measurement of the epithermal flux in the keV region.
Author (NSA)

N69-16042# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF VARIATIONS IN BOND ENERGY IN IRRADIATED MOLECULAR SYSTEMS [ETUDE DE LA VARIATION DE L'ENERGIE DE LIAISON DANS LES SYSTEMES MOLECULAIRES IRRADIES]
Gilbert Naudet and Suzanne Passe Apr. 1968 45 p refs In FRENCH
(CEA-R-3520) Avail: Issuing Activity

On the basis of experimental results selected from publications, the evolution of the bond energy of a molecular system under irradiation, leading to a more or less bound state, was studied. This variation of bond energy was then compared to the total bond energy of the initial system and to the energy absorbed in the system during the irradiation. This was done as a function of the nature of molecular system and the radiation spectrum and intensity. The working method is explained, and the results obtained are given.
Author (NSA)

N69-16043# Technische Hochschule Darmstadt (West Germany). Institut fuer Technische Kernphysik.
STUDIES OF NUCLEAR STRUCTURE ON THE DARMSTADT 80 MeD ELECTRON LINEAR ACCELERATOR [KERNSTRUKTURNTERSUCHUNGEN AM DARMSTAEDTER 60 MeV-ELEKTRONEN-LINEARBESCHLEUNIGER]
Apr. 1968 143 p refs In GERMAN
(BMwF-FBK-68-11) Avail: Issuing Activity

The results of research performed with the accelerator, the operating experience thus obtained, and the improvements made to the accelerator and experimental equipment are summarized. Using elastic electron scattering, nuclear radii were measured with high precision, whereas high-resolution inelastic electron scattering was used to investigate excited levels in light nuclei. In addition, nuclear photoeffect experiments were carried out with bremsstrahlung, and accelerator-produced radioactive nuclides were used for β- and α-decay studies as well as Mossbauer experiments.
Author (NSA)

N69-16044# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
STUDY OF SEMI-CONDUCTOR SPECTROMETERS FOR HIGH COUNTING RATES. APPLICATION TO THE STUDY OF THE REACTION P 31 (PROTON, ALPHA) FOR ENERGY LESS THAN 2 MeV [ETUDE DE SPECTROMETRES A SEMI-CONDUCTEURS POUR FORTS TAUX DE COMPTAGE. APPLICATION A L'ETUDE DE LA REACTION P 31 (PROTON, ALPHA) POUR ENERGIE LESS THAN 2 MEV]
Emile Ligeon (Grenoble Univ.) 1968 98 p refs In FRENCH
(CEA-R-3415) Avail: Issuing Activity

The study of nuclear reactions involving particles of low charge ($E < 2$ MeV) calls for spectrometers of high-resolving power. In many experiments however, the counting rate is high because of Coulomb scattering at the target: this results in a distortion of the experimental spectra and a loss of resolving power in the detection equipment. The first part is devoted to an evaluation of the resolving power obtained with silicon-detector spectrometers. A study of the elastic scattering of protons by ^{31}P shows which are the factors limiting the resolving power. In the second part the various types of spectrometers which can be used in the case of a high count rate are examined. An apparatus which can be used for carrying out spectrometry on particles produced by nuclear reactions, for a total count-rate of 10^6 counts/sec, is described. Our apparatus, used for the study of the reaction $^{31}P(p,\alpha)$ from 1 to 2 MeV, has made it possible to reduce the duration of an experiment by a factor of about 7. The ^{32}S levels have been studied and determined in the excitation range 9.881 to 10.838 MeV.
Author (NSA)

N69-16049# International Centre for Theoretical Physics, Trieste (Italy).
COMPTON SCATTERING FROM BOUND ELECTRONS
C. Fronsdal Sep. 1968 20 p refs Supported in part by the Natl. Sci. Found. Submitted for publication
(IC-68-85) Avail: CFSTI

An exact analytic expression for the matrix element for elastic Compton scattering from a K shell electron is obtained by a simple algebraic calculation in relativistic representation. Author (ESRO)

N69-16054# Argonne National Lab., Ill.
ANGULAR DISTRIBUTIONS OF THE RECOIL NUCLEI FROM THE REACTION F-19(P, PN)F-18 [UGLOVOE RASPREDELENIE YADER OTDACHI V REAKTSII F-19(P, PN)F-18]
F. P. Denisov et al Aug. 1968 4 p refs Transl. into ENGLISH from Yadern. Fiz. (Moscow), v. 7, no. 4, 1968 p 743–744
(ANL-Trans-656) Avail: CFSTI

Angular distributions of the recoil nuclei from the reaction $^{19}F(p,pn)^{18}F$ at the incident proton energy 660 MeV were measured. The Teflon targets were 1 mg/cm^2 thick. The angular distributions of ^{18}F have a maximum at angle of 80° in laboratory system. Author (NSA)

N69-16072# Chicago Univ., Ill. Enrico Fermi Institute.
MODEL FOR LOW ENERGY MESON-BARYON SCATTERING
Gary R. Goldstein Aug. 1968 104 p refs
(Contract AT(11-1)-264)
(COO-264-445; EFI-68-63) Avail: CFSTI

An effective Lagrangian, containing relativistic SU(6) invariant three and four-point interaction terms, is constructed for the scattering of the 35 meson representation by the 56 baryons. The lowest order matrix elements calculated from the Lagrangian include single particle exchange terms, that account for long range forces, and four-point interaction terms, that approximate short range forces for low energy scattering. Due to the imposition of free field conditions on the scattered particles, the amplitudes maintain a coplanar U(3) ⊗ U(3) symmetry, which is then broken by the mass differences in the multiplets. There are three parameters in the model that are fixed by the S_{11}, S_{31}, and P_{11} scattering lengths for πN elastic scattering. Unitarity is implemented without introducing more parameters, by equating the matrix elements to the reaction matrix, K. Author (NSA)

N69-16075# Commissariat a l'Energie Atomique, Bruyeres-le-Chatel (France). Centre d'Etudes.
CONTRIBUTION TO THE EXPERIMENTAL STUDY OF THE REACTIONS Se 9 (He 3, 3 α) AND B 10 (d, 3 α) [CONTRIBUTION a l'ETUDE EXPERIMENTALE DES REACTIONS Se 9 (He 3, 3 α) ET B 10 (d, 3 α)]
Pierre Thouvenin (Ph.D. Thesis—Paris Univ., Orsay) Mar. 1968 111 p refs In FRENCH
(CEA-R-3314) Avail: CFSTI

For studying these reactions, the detection of the final particles emitted in coincidence in the directions θ_1 and θ_2, together with the isoparametric analysis of the corresponding pulses were used. This method enables one to obtain the orthogonal Dalitz diagrams (E_1, E_2). An examination of the spectra obtained shows that the sequential mechanism appears to predominate. The contribution of the purely statistical process was less than 15 per cent of the total spectrum. In the case of $^{10}B(d,3\alpha)$, for E_d = 1.5, 2.66, and 3 MeV, the width of the peak of the first particles emitted, with respect to ^8Be excitations close to 11 MeV, was found to be equal to 2.6 ± 0.6 MeV, much less than the width of the second excited state observed by α-α scattering. The coincidence spectra and the free spectra give an excitation energy of E_x = 2.66 ± 0.07 MeV for the first excited state of ^8Be. Author (NSA)

N69-16088# Meiji-Gakuin Univ., Tokyo (Japan). Dept. of Physics.
INDIVIDUAL U(3) SYMMETRIES OF STRONG, ELECTROMAGNETIC AND WEAK INTERACTIONS
C. Itoh [1968] 5 p refs
Avail: CFSTI

The possibility of U(3)st, U(3)γ, and U(3)wk symmetries, under which Hst, Hγ, and Hwk are invariant respectively, is investigated, where U(3) is the usual (U3) of strong interactions. U(3) symmetry is assumed rather than SU(3) for strong interactions. It was previously shown that in order to describe a triplet of particles having integral values of charge and hypercharge, group (3) must be used rather than group SU(3). It is proved that integer charge is needed to define U(3)γ triplets and that quarks of SU(3) with fractional charges cannot be treated symmetrically with integrally charged leptons. The calculations demonstrate that U(3)st is violated by electromagnetic and weak interactions and possibly by medium strong interactions. U(3)γ and U(3)wk are violated by strong interactions. The μ-e br μ-ν mass difference also violate U(3) and U(3)wk invariances. Electromagnetic and weak interactions violate U(3) symmetries of each other. Thus, individual interactions Hst, Hγ, and Hwk satisfy their own U(3) symmetries. A.C.R.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-15050 Princeton Univ., N. J.
AN INVESTIGATION OF CURRENT SHEET STRUCTURE IN A CYLINDRICAL Z-PINCH
William R. Ellis, Jr. (Ph.D. Thesis) 1967 325 p
Avail: Univ. Microfilms: HC $14.65/Microfilm $4.20 Order No. 68-8921

Quantitative field measurements and current density distributions are obtained experimentally in the discharge chamber, using conventional electric and magnetic probes. Electron number densities, temperatures and collision frequencies are measured with a microwave reflection probe. The experimental data are related through appropriate continuum models to provide information on the mechanisms of gas acceleration and current conduction in the sheet. The sheet is found to have four interior zones wherein scalar or Hall conduction variously dominate, and ion current is found to be significant in two of these zones. Ionization profiles are obtained and a two step mechanism is suggested wherein initial photo-ionization is abetted by electron collisions. The velocity increase imparted during gas acceleration is found to be comparable with the sheet velocity, and the axial flow deflection is calculated to be small. Dissert. Abstr.

N69-15057 Oklahoma State Univ., Stillwater.
BOUNDARY CORRECTIONS FOR A THREE-COIL CONDUCTIVITY/VELOCITY PLASMA PROBE
Edward William Vendell (Ph.D. Thesis) 1967 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-8515

Analytical factors that modify electrical conductivity and velocity data taken by a three-coil instrument for the presence of a nearby cylindrical plasma boundary are derived, computed numerically, and compared with experimental results. The boundary-correction factors are then used to obtain conductivity and velocity profiles of an argon plasma jet. A three-coil probe that measures both the conductivity and velocity of laboratory plasmas having low magnetic Reynolds numbers is used. The present work was undertaken to extend previous theory by deriving factors that adjust for the existence of cylindrical boundaries. As a check of these numerical calculations, several computed values were compared

with experimental data taken in cylinders of acid. Since the agreement was satisfactory, the boundary-correction factors were used to reduce data taken as the probe was swept through an argon plasma generated by a constricted-arc wind tunnel. It was found that the raw data underestimates conductivity and overestimates velocity. Dissert. Abstr.

N69-15078 Iowa Univ., Iowa City.
EXPERIMENTS ON THE NONLINEAR BEHAVIOR OF PLASMAS
Ramesh Chand Ajmera (Ph.D. Thesis) 1967 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 67-16770

The problem presented in this thesis to a large extent is experimental. Experiments have been carried forth to detect various nonlinear phenomena that can exist in a plasma media. Detailed design considerations for mercury vapor discharge plasma tubes are given. Various microwave techniques are also presented. A discussion of the coupling from transverse to longitudinal waves via the Tonks–Dattner resonances is presented. We extend two recent experiments of Stern and Tzoar concerning the nonlinear interaction of two waves in a plasma to experimentally demonstrate that propagating surface waves can be launched through either nonlinear mechanism. In addition we measure a dispersion curve for these waves. A second experiment demonstrates that the zeroth order distribution function can be modified with a relatively small amount of incident power irradiating a plasma column. Dissert. Abstr.

N69-15104 Wisconsin Univ., Madison.
APPLICATION OF THE MICROWAVE FABRY–PEROT RESONATOR TO PLASMA DIAGNOSTICS
Roger James Chaffin (Ph.D. Thesis) 1967 159 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 67-16907

A theory for the measurement of the change in resonator Q through a measurement of the resonator transmission coefficient is presented and experimentally verified. This technique is shown to have certain advantages under noisy conditions. The diagnostics of an anisotropic plasma is examined both theoretically and experimentally and it is found that weak magnetic fields do not affect the plasma diagnostics, but stronger fields can have a significant effect which may be theoretically predicted. The diagnostics of time varying plasmas with a Fabry–Perot resonator was examined. It was found that for small low density plasma regions the time varying diagnostics are easily performed. However, for larger, more dense plasma regions such as might be found in a magnetic mirror machine, a more complicated system is required. Some of these systems were investigated experimentally and their characteristics are discussed. Dissert. Abstr.

N69-15129# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Computing Techniques and Automation.
DISSIPATIVE SPECTRAL TRANSFORMATIONS OF TURBULENT PULSATIONS IN PLASMA
V. G. Makhan'kov and V. N. Tsytovich 1968 15 p refs In RUSSIAN
(JINR-P9-4042) Avail: CFSTI

Using hydrodynamic equations, the nonlinear plasma currents are obtained if $\omega_- \cdot k_- \cdot V_{T_0} << \nu_e$, $\omega_- = \omega_1 - \omega_2$, $|\vec{k}_-| = |\vec{k}_1 - \vec{k}_2|$, $\omega_{1,2}$, $k_{1,2}$ (frequencies and wave vectors of intersecting pulsations). They correspond to those obtained earlier on the basis of Vlasov equations. The excitation of low-frequency acoustic waves due to the hf wave beam is discussed. It turns out that, in particular cases, dispersion of low-frequency acoustic waves is determined by hf wave energy density. Author (NSA)

N69-15131# Joint Inst. for Nuclear Research, Dubna (USSR). Lab of Computing Techniques and Automation.
STOCHASTIC HEATING OF PLASMA PARTICLES
V. G. Makhan'kov and V. N. Tsytovich 1968 18 p refs In RUSSIAN
(JINR-P9-4044) Avail: CFSTI

The theory of stochastic heating is derived, with stochastic electromagnetic field correlation effects taken into account. Author (NSA)

N69-15208# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
HIGH TEMPERATURE PLASMA WITH A COLD GAS BLANKET IN A TOROIDAL MAGNETIC FIELD
H. H. Barghahn, W. Feneberg, F. Karger, and G. Venus Jul. 1968 20 p refs
(IPP-6/67; IPP-3/76) Avail: CFSTI

The questions considered are whether an arc in a toroidal magnetic field can burn in a stable manner in the centre of the vessel or whether it is displaced to the wall, and how large the energy losses and axial temperature are compared with those of an arc in a linear magnetic field. To solve this problem using the classical heat conduction equations for ions and electrons, the temperature profile resulting from ohmic heating was calculated as a function of time. Since the thermal conductivity parallel to the magnetic field is high, the temperature in the hot regions is constant on the magnetic surfaces. The magnetic surfaces are formed by superposition of the magnetic field produced by the discharge current on the high longitudinal field. The rotational transform thus obtained ensures that the plasma is in equilibrium. The position of the plasma is given by the wall isotherms. Author

N69-15255# Princeton Univ., N. J. Plasma Physics Lab.
ON NONLINEAR HIGH-FREQUENCY PLASMA CONDUCTIVITY
A. Salat and P. K. Kaw Oct. 1968 10 p refs
(Contract AT(30-1)-1238)
(MATT-638) Avail: CFSTI

Numerical results are presented for the hf nonlinear conductivity of a fully ionized plasma. Special attention was given to the case when the frequency ω of the applied electromagnetic field is close to the electron plasma frequency ω_p. Apart from its intrinsic theoretical interest, this frequency range is of relevance to the problem of production and heating of plasmas by laser irradiation. NSA

N69-15282# Brussels Univ. (Belgium).
SPECTROSCOPIC DETERMINATION OF THE DENSITY AND ELECTRONIC TEMPERATURE OF A HYDROGEN PLASMA [DETERMINATION SPECTROSCOPIQUE DE LA DENSITE ET DE LA TEMPERATURE ELECTRONIQUES D'UN PLASMA D'HYDROGENE]
R. van Hauwermeiren (Ph.D. Thesis) 1967 226 p refs In FRENCH
(NP-17588) Avail: CFSTI

A technique is developed for the measurement of N_e and T_e, which is simple and systematic. The method permits both these magnitudes to be determined from a single phenomenon and their evolution to be followed. The first part of the work is concerned with a synthesis of the theory on the basis of plasma spectroscopy; the theory is applied to the determination of T_e and N_e. A new method for the determination of the density is developed. The principle of the method consists in the simultaneous measurement of the intensity emitted in one line with two different chemical lengths. The development and testing of the apparatus for putting the method into operation is described. The experimental results obtained are reported and discussed. NSA

N69-15308*# Utah State Univ., Logan.
BOUNDARY CORRECTIONS FOR A COAXIAL THREE-COIL CONDUCTIVITY/VELOCITY PLASMA PROBE Final Report
Vikram K. Kinra (M.S. Thesis) 1968 79 p refs
(Grant NGR-45-002-011)
(NASA-CR-99006) Avail: CFSTI CSCL 20I

Several configurations of immersible three-coil devices have been proposed that measure local values of electrical conductivity and velocity in unbounded conducting fluids at low magnetic Reynolds numbers. Using a previously tested configuration of three coils mounted on separate support rods, the theory was extended to account for the presence of a finite cylindrical boundary. The present work was concerned with an improved probe that further decreases the flow perturbation effects of the previous design by mounting the three coils on a single support rod. Cylindrical boundary correction factors are computed and compared with experimental data taken in cylinders of quiescent electrolyte. The results are found to agree within 10 percent. Author

N69-15312*# Catholic Univ. of America, Washington, D. C. Dept. of Space Science and Applied Physics.
DIAGNOSTICS OF ACCELERATING PLASMA Semiannual Progress Report, 1 Mar.-31 Aug. 1968
T. N. Lie, K. F. Lee, and E. A. McLean 1 Dec. 1968 45 p refs
(Grant NGR-09-005-025)
(NASA-CR-99042; Rept-68-011; SAPR-5) Avail: CFSTI CSCL 20I

Electron temperatures and densities behind the incident and reflected shock front in the T-type electromagnetic shock tube were determined using the laser light scattering method. Since this method only depends on the assumption of the Maxwellian velocity distribution of the plasma particles, the electron temperatures thus obtained are independent of the local thermal equilibrium (LTE) assumption in the plasma. The laser scattering temperatures are then compared with the spectroscopic temperature which depends on LTE condition. It was found that the two temperature well agree within the experimental uncertainty, indicating that the LTE assumption in the spectroscopic temperature determination is a reasonable approximation. As a preliminary study for the coaxial plasma accelerator, the stability of a plasma having two components of different drift velocities and temperatures and bounded by a conducting cylinder was investigated. In conjunction with the geometrical parameters given earlier, the derived formulas for velocity thresholds, maximum wave number, and number of unstable modes in a system formulas can be applied to streaming instabilities under a variety of conditions. It is seen that the instability depends sensitively on both the geometry and the temperature ratio of the two components. Author

N69-15334# Princeton Univ., N. J. Plasma Physics Lab.
HYDROMAGNETIC EQUILIBRIUM OF TOROIDAL PLASMA WITH CIRCULAR HARD CORE
Horst D. Pacher Oct. 1968 30 p refs
(Contract AT(30-1)-1238)
(MATT-645) Avail: CFSTI

The hydromagnetic equilibrium problem is solved for an annular toroidal plasma having a toroidal hard core in the limit of large aspect ratio and zero azimuthal plasma current. The plasma is enclosed in a toroidal perfect conductor and subjected to an external field. Plasma pressure is taken to vary directly with the logarithm of distance from the hard core. It is found that the isobaric surfaces shift in a plane perpendicular to the axis. The shift is found to consist of three terms: a shift away from the axis depending only on the curvature and the radius of the outer conductor, a shift away from the axis depending only on the pressure and the hard core current which increases with distance from the hard core, and a shift toward the axis depending on the outer conductor radius, the plasma pressure, and the hard core current. The maximum ratio of plasma pressure to poloidal field pressure for which the theory is applicable in any cas is found to be 0.75 times the aspect ratio. Author (NSA)

N69-15345# Technische Hochschule Munchen (West Germany). Fakultaet fuer Maschinenwesen und Elektrotechnik.
THE BEHAVIOR OF PLASMAS AS DIELECTRICS BETWEEN CONDENSOR PLATES [UEBER DAS VERHALTEN VON PLASMEN ALS DIELEKTRIKUM ZWISCHEN KONDENSATORPLATTEN]
Horst Beutil (Ph.D. Thesis) 1968 19 p refs In GERMAN
Avail: CFSTI

The conductance value in the frequency range from 30 to 427 MHz was determined for a plate condenser whose dielectric was formed by a low pressure mercury vapor discharge resulting in an inhomogeneous plasma without magnetic field. Smith diagrams were produced showing the progression of the complex plasma conductance value as a function of electron density, measured frequency, vapor pressure, and plate size. Using the Eccles formula, the progression of the blank conductance value of the plasma may be explained as being a nearly homogeneous plasma core surrounded by boundary layers nearly void of electrons up to the plates. The effective conductance value of the plasma is not only affected by the impact, but also by the stimulation through electromagnetic waves. This effect and the resonance travel time result in the characteristic deviation from the anticipated values. K.W.

N69-15354# Kernforschungsanlage, Juelich (West Germany). Institut fuer Plasmaphysik.
STUDY OF THE ACCELERATION OF A PLASMA THROUGH A PULSED ELECTROMAGNETIC TRAVELING FIELD
Wolfgang Bieger May 1968 70 p refs In GERMAN
(JUL-524-PP) Avail: CFSTI

The process in the acceleration of a plasma through a pulsed electromagnetic traveling wave was investigated in an experiment in which a wave with increasing velocity was propagated by a special transmission chain. The plasma was produced in a conical ring discharge and introduced into the solenoid of the chain. The temperature is sufficiently high to prevent a penetration of the field of the traveling wave during the acceleration period so that a magnetic bottle can be formed. If the density of the plasma at the beginning of the acceleration is sufficiently small, so that the magnetic pressure of the bottle exceeds the kinetic pressure of the plasma, the plasma is accelerated to velocities up to 10^8 cm/sec. The process can then be described by a free-particle model which gives an energy distribution for the ion of the accelerated plasma which agrees well with the experimentally determined values. It follows that during the complete acceleration period a magnetic bottle must exist so that the relatively small losses are to be considered only when an electrostatic field is assumed in the layer between plasma and magnetic field. The losses are limited partially by reflection of the ions from the acceleration direction in the collision with the bottle. Author (NSA)

N69-15360# Los Alamos Scientific Lab., N. Mex.
HOLOGRAPHIC PLASMA DIAGNOSTICS
F. C. Jahoda 27 Aug. 1968 9 p Presented at Am. Phys. Soc. Meeting on Plasma Phys., Fluid Dyn., Electron and Atomic Phys., Los Alamos, N. Mex., 17-19 Jun. 1968
(Contract W-7405-ENG-36)
(LA-3998-MS) Avail: CFSTI

The uses of holography in plasma diagnostics are reviewed. Holographic interferometry is the most significant technique. Author (NSA)

N69-15364 Ohio State Univ., Columbus.
THE INTERACTION OF INTENSE MICROWAVE FIELDS WITH INITIALLY HEATED AIR
Joseph Thomas Mayhan (Ph.D. Thesis) 1967 168 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-8855

A model governing the propagation of a short duration intense electromagnetic field intense electromagnetic field in initially heated air is described and applied to predicting the nonlinear breakdown of a shock induced plasma. Certain kinetic processes involving N_2, NO and O for 4000-5000°K air are examined in order to determine the nonlinear response of the field transmitted through the plasma. Evolution of the electron temperature throughout the plasma is specified upon incorporating these kinetic processes. It is found that the maximum electron temperature increase is inhibited by inelastic energy losses in exciting N_2 and ionizing NO. Ionization rates of initially heated air at 4500°K are presented and found to be substantially greater than room temperature ionization rates and ionization rates in the 3000-4000°K range. Dissert. Abstr.

N69-15369 Illinois Univ., Urbana.
GENERALIZED STOCHASTIC EQUATIONS AND THEIR APPLICATIONS TO PLASMAS
Kam-Chuen So (Ph.D. Thesis) 1967 99 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-8231

A new formulation of the Fokker-Planck method is established. It is observed that the coefficients actually involve conditional averages of functionals of the random field. Furthermore, just as a Fokker-Planck equation can be used to describe the lowest distribution, similar equations can also be used to describe higher distributions. Such a set of equations is called generalized stochastic equations. These equations are applicable to systems perturbed by small random forces provided sufficient knowledge regarding the unperturbed system is available. When the random forces are specified statistically, the generalized stochastic equations give immediate results. Of particular interest in plasma applications is the heating of electrons by random electric fields. Results indicate that the use of a Vlasov equation in finding the polarization effect is justified. Finally, a similarity is observed between the set of generalized stochastic equations and the BBGKY hierarchy. Dissert. Abstr.

N69-15430# Academy of Sciences (USSR), Moscow.
Hg AND Cs AS WORKING MEDIA FOR STUDIES OF CERTAIN PROPERTIES OF MHD GENERATORS WORKING IN A RANKINE CYCLE
Ya. A. Kreev, V. T. Karpukhin, and A. V. Nedospasov 1967 13 p refs Presented at the Symp. on Magnetohydrodyn. Elec. Power Generation, Warsaw, 24-30 Jul. 1968
(SM-107/130; CONF-680704-3) Avail: CFSTI

The results of the experimental and theoretical investigations aimed at the characteristics of the Hg-Cs plasma in crossed electrical and magnetical fields are described. Calculations are shown for MHD generators with the real (turbulent) conductivity in nonequilibrium plasma, and estimations of achievable efficiency and the degree of efficiency of the plant working with these media are made. Author (NSA)

N69-15440# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
CONTRIBUTION OF NEUTRAL ATOMS TO THE ABSORPTION OF PHOTONS IN PLASMA
H. S. Tsai, A. Z. Akcasu, and R. K. Osborn Aug. 1968 135 p refs
(Contract DA-31-124-ARO-D-403; ARPA Order-675; Proj. Defender)
(AD-677375; REPT-07599-18-T) Avail: CFSTI CSCL 20/9

The index of refraction and the attenuation coefficient per unit time, as well as per unit length, has been obtained for an arbitrary medium using Maxwells wave theory. Results are expressed in terms of the microscopic currents due to the motion of the particles in the medium. The contribution of the neutral atoms to the absorption of photons in plasmas has also been investigated by extending the Akcasu and Walds work on the absorption due to the inverse bremsstrahlung of electrons in the field of neutral atoms to higher electron temperatures and higher photon energies. This problem was formulated by using plane waves for electron wave function. In this way an expression has been obtained for the absorption of coefficient per unit length due to the above absorption mechanism in terms of the elastic and inelastic electron-atom scattering cross sections allowing the atoms initially to be in any excited state. The absorption coefficient has been calculated explicitly for hydrogen atoms; the results are presented graphically as a function of electron temperature and radiation frequency. Author (TAB)

N69-15464# Miami Univ., Coral Gables, Fla. Dept. of Physics
THE ONSET OF THE HELICAL INSTABILITY IN WEAKLY IONIZED DISCHARGE PLASMAS
Harry S. Robertson and Edward H. Currie Jun. 1968 10 p refs
Its Plasma Phys. Bull., Vol. 8, No. 2
(Contract AT(40-1)-2454)
(MIAPH-PL-68-5) Avail: CFSTI

The helical instability in a discharge plasma has been variously reported, sometimes as having an explosive onset, sometimes as reversible. It was found experimentally that in cesium arc plasmas, the onset is always explosive provided the ambient noise level is low enough; hysteresis is normally present; and plasma parameters change discontinuously at the onset and extinguishment of the instability. In the presence of noise, however, one finds the onset to be reversible and continuous. Author (NSA)

N69-15496# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
KINETIC DESCRIPTION OF PLASMA IN AN EXTERNAL FIELD. 2: RING APPROXIMATION [ROWNANIE KINETYCZNE DLA PLAZMY W POLU ZEWNETRZNYM. 2: PRZYBLIZENIE TYPU RING]
A. Kuszell and A. Senatorski 1968 44 p refs
(INR-P-928) Avail: CFSTI

The kinetic equation for plasma in an external nonuniform and nonstationary electromagnetic field in a ring approximation is derived. The system is described by two coupled equations, the kinetic equation for one-particle distribution function, and the Vlasov equation linearized around the solution of kinetic equation. The last equation determines an auxilliary function appearing in the collision operator. A method of solution of this equation based on hydrodynamical concepts is proposed. In the zeroth order of approximation (hydrodynamic approximation), the collision integral is found explicitly. The time evolution of the contribution of an initial two-particle correlation is discussed. Author (NSA)

N69-15516# Miami Univ., Coral Gables, Fla. Dept. of Physics.
AMBIPOLAR DIFFUSION IN RF-EXCITED MAGNETO PLASMAS. PLASMA PHYSICS BULLETIN, VOLUME 8, NUMBER 1
Harry S. Robertson and John J. Herring Jun. 1968 13 p refs
(MIAPH-PL-584-Vol-8-No-1) Avail: CFSTI

A theoretical analysis of ambipolar diffusion in electrodeless, weakly ionized, collision-dominated, rf-excited magnetized plasmas reveals an essential dependence of the steady-state density profile on the electron-density dependence of the net volume-ionization rate. In particular, if and only if the ionization rate is simply proportional to the electron density, the particle fluxes are ambipolar;

otherwise there exist divergenceless current cells for which the axial and radial current densities are not everywhere zero. Experimentally, it was found impossible to produce a uniform such plasma in argon, where the ionization process is two-stage, and goes as n^2, whereas the same method of excitation easily yielded a uniform cesium vapor plasma, for which the ionization process is proportional to n. Author (NSA)

N69-15517# Wisconsin Univ., Madison. Dept. of Electrical Engineering.

PLASMA INSTABILITIES AND WAVES EXCITED BY AN ANISOTROPIC ENERGY DISTRIBUTION PRODUCED BY ELECTRON CYCLOTRON RESONANCE Quarterly Progress Report

J. L. Shohet 15 Sep. 1968 22 p refs

(Contract AT(11-1)-1695)

(COO-1695-13; QPR-6) Avail: CFSTI

The purpose of this research is to investigate the ability of a short pulse of electron cyclotron resonance radiation to produce an anisotropic energy distribution of electrons in a plasma and the instabilities and waves produced by this anisotropy. In particular, the nature of the rf heating mechanism and the behavior of the radiation emitted from the plasma will be considered. The ECR device was operated to obtain wall bremsstrahlung measurements, plasma diamagnetism, electron flux, and electron density in the discharge. An instability in the operation of the device was observed. Theoretical work is under way to determine the nature of this instability as well as a new method for evaluating the eigen-frequencies of a microwave cavity filled with a plasma of variable density. Relativistic X-ray bremsstrahlung theory was expanded. NSA

N69-15521# California Univ., Los Angeles. Dept. of Physics.

PLASMA DYNAMICS AND INTERACTION WITH HIGH FREQUENCY FIELDS Final Scientific Report, Feb. 1, 1966–Feb. 1, 1968

K. R. MacKenzie 12 Apr. 1968 6 p refs

(Grant AF-AFOSR-567-66)

(AD-677296; AFOSR-68-2184) Avail: CFSTI CSCL 20/9

Under a previous grant the plasmas were produced primarily by feeding high frequency energy from an oscillator to electrodes in a magnetic field. Toward the end of the grant period, this effort was de-emphasized in favor of a method for generating the plasma by photoionization. These photons have very high frequencies and energies. The photoionized plasmas have been so fruitful that this phase of the research was expanded considerably under the present grant. Three independent photoionization facilities are now in operation. The largest was used to confirm a quasi-linear theoretical prediction by Field and Fried of this department, in which a suddenly applied electric field causes a plasma current to increase and then sharply decrease due to the growth of ion acoustic waves. The agreement between theory and experiment turned out to be extremely good. The second piece of apparatus was used to measure the expansion and diffusion of a plasma column with and without the presence of a longitudinal magnetic field. The third piece of apparatus was designed to examine the behavior of large plasma density perturbations. TAB

N69-15524# California Univ., Livermore. Lawrence Radiation Lab.

SUPERCONDUCTING MAGNETS FOR CONTROLLED THERMONUCLEAR RESEARCH

Clyde E. Taylor 23 Aug. 1968 15 p refs Presented at Conf. (Summer) on Superconducting Magnets, Upton, N. Y., 8–12 Jul. 1968 Submitted for publication

(Contract W-7405-ENG-48)

(UCRL-71261; CONF-680714-1) Avail: CFSTI

Some of the general considerations for magnetic fields used in controlled thermonuclear research are outlined along with a list of a few of the early superconducting coils which have been built for this purpose and a list of coil systems now planned or under construction. NSA

N69-15534# California Inst. of Tech., Pasadena.

PLASMA DYNAMICS Final Report

R. W. Gould, Robert H. Hertel, Fred L. Hinton, A. M. Messiaen, and D. G. Swanson Jan. 1968 56 p refs

(Contract AF 49(638)-1462)

(AD-677666; AFOSR-68-2305) Avail: CFSTI CSCL 20/9

This is a final report and presents a summary and reprints of published papers on research accomplishments attained under the contract. The results are both experimental and theoretical in the general area of the interaction of plasmas and electromagnetic waves. On the experimental side a method was developed for employing hydromagnetic waves for plasma diagnostics. A microwave radiometer was developed capable of measuring the transient behaviour of noise radiation with a time resolution of 10 microseconds and a sensitivity of 30 K. Among the theoretical results anomalous radiation was found near the plasma frequency and not associated with charged particle collisions. Alternatives to formal plasma kinetic theory were developed which makes the physics more obvious. For example, microscopic density fluctuations are treated by considering particle-particle interactions as small perturbations on independent straight-level motions of charged particles. Author (TAB)

N69-15616# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.

POWER RADIATED BY OSCILLATING MAGNETIC AND OSCILLATING ELECTRIC DIPOLES IN A COLD, STREAMING PLASMA

John E. Bergeson Nov. 1968 29 p refs

(D1-82-0793) Avail: Issuing Activity

The power radiated by oscillating magnetic and oscillating electric point dipoles is calculated for the case where the dipoles are immersed in a cold, *streaming* plasma. The power output of the dipoles in a streaming plasma is less than it is in a stationary plasma, although the correction term is of order β^2, where β is the ratio of the plasma's streaming velocity to the velocity of light. The power output is calculated by a generalized Poynting vector method, using electromagnetic field expressions derived from a set of linearized, covariant cold plasma equations. The results are compared with calculations of the power output of the oscillating electric dipole from a "dispersive medium" point of view. Author

N69-15638# Academy of Sciences (USSR), Moscow. Institut Atomnoi Energii.

THE NATURE OF THE PROFILE ASYMMETRY OF H SPECTRUM LINES IN DENSE PLASMA

G. V. Sholin 1967 28 p refs In RUSSIAN

(IAE-1440) Avail: Issuing Activity

A systematic theory of profile asymmetry of H spectrum lines in dense plasma based on a quasi-static treatment of the ions and an impact treatment of the electrons is developed. It is shown that the principal reason for asymmetry is heterogeneity of the electric microfields, where quadrupolar interaction plays the main role, whereas the influence of the quadratic Stark effect, the corrections, linear with respect to the electric field of the ions ($E \sim e/R^2$), to the forces of the oscillators, the transition from the frequency scale to the wavelength scale and the multiplier ω^4 in the expression for the intensity of the components and the octuple interaction are effects of the following order with respect to the small parameter of the problem $\lambda = n^2 a_0/R$. Corrections of the quadratic interaction are very essential not only in the formulas for the energy of the Stark components but also in the expressions for their intensity. A qualitative interpretation is given of the experimentally observed asymmetry of the lines Ly-α and H_β and calculated data are presented for the asymmetry of the Lyman, Balmer and Paschen lines. NSA

N69-15679# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
PLASMA EFFECTS IN SEMICONDUCTORS
Betsy Ancker-Johnson Oct. 1968 44 p refs Submitted for publication
(D1-82-0772) Avail: Issuing Activity

The review begins with a survey of nonequilibrium plasma production methods and the properties of such plasmas in their as-produced state. The methods are injection, impact ionization, and two-photon absorption. The description of the as-produced properties includes previously unpublished information about plasma distribution during injection and characteristic times involved in plasma decay. Two plasma effects, beyond those associated with plasma production, are discussed in detail, namely the pinch effect and microwave radiation. The status of the theories and experiments describing pinch formation and its properties thereafter are critically examined so that the open questions emerge. No theory for microwave radiaton exists. The plethora of observations are grouped into four sets of characteristics: the threshold conditions, the spectrum of the radiation, its polar dependence, and the attendant low frequency (MHz) resistance oscillations. Author

N69-15716*# Illinois Univ., Urbana. Antenna Lab.
EXPERIMENTAL STUDY OF THE IMPEDANCE OF A SHORT DIPOLE IN A PLASMA FOR PARALLEL AND PERPENDICULAR ORIENTATION WITH RESPECT TO THE DC MAGNETIC FIELD
Dan E. Snyder and R. Mittra Dec. 1968 40 p refs
(Grant NGR-14-005-009)
(NASA-CR-99141; SR-11; REPT-68-4) Avail: CFSTI CSCL 20I

Measurements were made of the input admittance of a small dipole immersed in a steady-state plasma with an external magnetic field. Antenna orientations parallel and perpendicular to the magnetic field were studied. The data were compared to theoretical expressions derived previously by Balmain and fairly good qualitative agreement was found. Author

N69-15764*# Illinois Univ., Chicago.
NEAR-SURFACE ELECTRON TEMPERATURE OF WEAKLY IONIZED PLASMA ACCORDING TO KINETIC THEORY
Paul M. Chung Nov. 1968 44 p refs
(Grant NGL-14-012-012)
(NASA-CR-99047) Avail: CFSTI CSCL 20I

Properties of electrons near absorbing and emitting surfaces have been studied for weakly ionized plasma by analyzing the Boltzmann equation governing the electrons. For simplicity, it was assumed that the electric field intensity is given a priori. It was shown that there exists a nonequilibrium absorption layer, near the surface, wherein the kinetic distribution of electrons is completely out of equilibrium for all values of the mean free path, when the surface is highly absorbent with small or no electron emission. This layer is responsible for the large electron temperature jump at the surface, and it governs the electron temperature profile through the continuum as well as the rarefield plasmas. It was found from the analysis that the simple surface boundary condition for continuum electron energy equation previously employed by the author is correct when there is no surface emission. Similar simple surface boundary condition is deduced for surfaces with given finite emission rates. Author

N69-15888# City Coll. Research Foundation, New York.
VISUALIZATION OF PLASMA FLUTES IN A Q-MACHINE Interim Scientific Report
Joseph C. Cataldo and Norman C. Jen 20 Nov. 1968 8 p refs Repr. from Phys. Fluids, v. 11, no. 9, Sep. 1968 p 2087-2088
(Grant AF-AFOSR-1093-67)
(AD-678358; AFOSR-68-2639) Avail: CFSTI CSCL 20/9

The plasma camera has been used to observe flute modes in a single-ended Q-machine. The flutes, rotating in the E x B direction, are irregular extensions of the plasma column and exhibit a convective mass transfer phenomenon by the breaking off of the flutes. Author (TAB)

N69-15923# Institut fur Plasmaphysik G.m.b.H., Garching (West Germany).
EXPERIMENTAL INVESTIGATION OF CURRENT DENSITY DISTRIBUTIONS AND RELAXATION EFFECTS IN AN ARGON-POTASSIUM PLASMA STREAMING THROUGH A CHANNEL WITH SEGMENTED ELECTRODES [EXPERIMENTELLE UNTERSUCHUNG VON STROMDICHTEVERTEILUNGEN UND RELAXATIONSEFFEKTEN IM STROEMENDEN ARGON-KALIUM-PLASMA EINES KANALS MIT SEGMENTIERTEN ELEKTRODEN]
G. Dodel Nov. 1967 p 57 refs In GERMAN; ENGLISH summary
(IPP-3/63) Avail: CFSTI

Electron temperature distributions were measured in an argon-potassium plasma streaming through a channel with an electrode array similar to that of a Faraday-type MHD generator to provide information about the current distribution. A calculated model shows that relaxation effects of the electron density are indeed significant and may cause considerable deviations of the local electron density from the relevant Saha values. Measurements without and with magnetic field were made under non-periodic and under approximately periodic conditions, which especially in the non-periodic case indicated considerable influence of relaxation. ESRO

N69-16029# Technische Hochschule Hannover (West Germany). Institut Fuer Theoretische Physik.
THEORETICAL AND EXPERIMENTAL INVESTIGATIONS OF THE MICROFIELD IN A FULLY IONIZED PLASMA [THEORETISCHE UND EXPERIMENTELLE UNTERSUCHUNGEN ZUM MIKROFELD IM VOLLIONISIERTEN PLASMA]
R. W. Lorenz *In* Fernmeldetech. Zentralamt Kleinheubacher Rept., Vol. 11 1966 p 273-276 refs In GERMAN (See N69-15964 05-13)
Avail: CFSTI

From theoretical investigations extended by computer calculations for a 4000-particle plasma it appeared that the hitherto used Holtsmark distribution of field strengths for an arbitrary point, being ergodic, cannot describe the total microfield action if the Debye length is large compared to the mean particle distance. A temperature dependent far-field portion has to be added which is governed by a Gaussian distribution. The results obtained are of interest in the study of transport coefficients, the Stark-effect and the thin plasma of the solar corona. ESRO

N69-16066# Los Alamos Scientific Lab., N. Mex.
EQUILIBRIA OF COLLISIONLESS PLASMA
Richard L. Morse Dec. 1967 3 p
(Contract W-7405-ENG-36)
(LA-3844) Avail: CFSTI

A brief exposition is given on the current theoretical "conventional wisdom" about θ pinch equilibria and the related effects of end shorting, from the point of view of the Vlasov equations. Author (NSA)

N69-16080# California Univ., Los Angeles. Plasma Physics Group.
TRANSVERSE PLASMA WAVE ECHOS
Burton Fried and Craig Olson Oct. 1968 13 p refs Sponsored in part by TRW Systems, Redondo Beach, Calif.
(Contract Nonr-4758(01))
(AD-678380; R-37) Avail: CFSTI CSCL 20/9

Transverse plasma echos can arise from two spatially separated, steady-state excitations, a transverse one at frequency omega 1 and a longitudinal one at frequency omega 2. Our theoretical results for the location, polarization, and other characteristics of these echos, which have frequency omega 1 plus or minus omega 2, take into account collective effects, as found from the Vlasov equation. The variety of phenomena involved is much greater than in the case of two longitudinal excitations. Author (TAB)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N69-15030# Technische Hochschule München (West Germany).
CHARGE CARRIER INJECTION AND SPECTRAL SENSITIZATION OF PERYLENE [LADUNGSTRAEGERINJEKTION UND SPEKTRALE SENSIBILISIERUNG AM PERYLEN]
Frank Rebentrost (Ph.D. Thesis) 1968 59 p refs In GERMAN
Avail: CFSTI

Perylene was chosen as the model substance of an organic semiconductor because of its energetic characteristics. The injection of electrons and defect electrons and the spectral sensitization with dyes were performed on single crystals of 6 to 30 μ thickness grown from solution. It was found that electrolytic contacts containing Ce^{4+}, Fe^{3+}, $K_2Fe(CN)_6$, or O_2 are very well suited for injection. Space-charge-limited currents at least up to 1 mA/cm^2 can be measured. Electrons can be injected into perylene with a solution of the anthracene $^-$ radical in tetrahydrofuran. The photocurrent of perylene can be sensitized by means of dyes in their absorption range. Rhodamin B and pseudoisocyanine are excellent sensitizers. The spectral sensitization was found to be affected by the redox systems. It is postulated that sensitization is possible only as long as an electron acceptor is present. Transl. by K.W.

N69-15031# Eidgenossische Technische Hochschule, Zurich (Switzerland).
FREE MIXING GALLIUM ARSENIDE [VERSETZUNGSFREIES GALLIUMARSENID]
Ulrich Zimmerli (Ph.D. Thesis) 1968 41 p refs In GERMAN
Sponsored in part by Battelle Mem. Inst., Geneva
(DISS-4072) Avail: CFSTI

The production of dislocation-free GaAs crystals by vertical growth from solution and in closed systems with magnetic seed suspension is described. Probable dislocation structures in the zinc blende grid and practical methods for proving the presence of dislocations are discussed. Two conditions were observed which will preclude the formation of dislocations from the seed: the drawing-out of a thin crystal neck, and the reduction of the radial and axial temperature gradient by varying the form of the crucible empirically until optimal reproducible results are obtained. The newly formed dislocations in the end of the crystal can be clearly grouped as to sources. The types of dislocation correspond to the expected structures. Dislocation density and pattern are governed by the temperature distribution in the solid crystal during the growth process. Transl. by K.W.

N69-15043# Technische Hochschule Munchen (West Germany).
INVESTIGATION OF THE RECRYSTALLIZATION OF SPONGY ZIRCONIUM [UNTERSUCHUNGEN ZUR REKRISTALLISATION VON SCHWAMZIRKON]
Winfried Reinach (Ph.D. Thesis) [1968] 121 p refs In GERMAN
Avail: CFSTI

Recrystallization kinetics of zirconium were observed by macro-hardness, micro-hardness, and radiological measurements on reactor grade metal sheets in order to obtain the recrystallization diagram for high temperatures. Evaluation of measured data established the dependence of macro-hardness values on loads. Zirconium structures showed pronounced relaxation after 20% deformation but without a sharp division between decrystallization and recrystallization processes. A linear correlation was found between the grain numbers in primary recrystallization and the logarithm of the metal sheet thickness ratio in comparison to original and final thickness after deformation. A critical deformation factor of about 3% was obtained for the investigated metal sheet. Transl. by G.G.

N69-15071 Pittsburgh Univ., Pa.
MAGNETIC PROPERTIES OF SOME 2:17 INTERMETALLIC COMPOUNDS OF LANTHANIDE METALS WITH NICKEL
Paul Darwin Carfagna (Ph.D. Thesis) 1967 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-8320

The binary intermetallic compounds Ln_2Ni_{17}, where Ln = Y, Sm, Gd, Tb, Dy, Ho, Er, Tm, and Lu, were investigated to determine their bulk magnetic properties. The purpose of this investigation was to ascertain whether or not the magnetic characteristics of the Ln_2Ni_{17} compounds are significantly different from those of other Ln–Ni binary compounds in which the nickel atoms are non-magnetic. Saturation moments at 4.2°K and thermomagnetic analysis data from 4.2°K to ~640°K were obtained. The saturation data at 4.2°K can be satisfactorily explained by a two sublattice model where the lanthanide ions make up one ferromagnetic sublattice and the nickel atoms make up a second ferromagnetic sublattice. These two sublattices are then coupled ferromagnetically or antiferromagnetically for the light and heavy lanthanide compounds respectively. By making certain logical assumptions regarding electron transfer from the lanthanide ion to the nickel d-band, an average moment of 0.25 μ_B per nickel atom was calculated for the Ln_2Ni_{17} compounds. Dissert. Abstr.

N69-15073 Stanford Univ., Calif.
SOME EFFECTS OF GAMMA RADIATION ON SILICON AND SILICON DEVICES
De Witt Landis, Jr. (Ph.D. Thesis) 1967 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-6449

This work is based on the use of the Shockley–Read–Hall (SRH) defect theory to predict bulk radiation damage effects in semiconductor materials and devices, and conversely, the use of radiation data from materials and devices to obtain information on the SRH defect parameters. The experimental work is limited to room-temperature cobalt-60 gamma irradiation of silicon devices and of boron- and phosphorus-doped crucible-grown silicon containing $2 - 8 \times 10^{17}$ oxygen atoms-cm^{-3}; the theory is valid for any semiconductor in any radiation environment as is illustrated by examples utilizing data from the literature. Dissert. Abstr.

N69-15086 Oregon State Univ., Corvallis.
THE PHASE DIAGRAM OF ZIRCONIUM AND CHROMIUM WITH SPECIAL REFERENCE TO THE TRANSFORMATION IN THE INTERMETALLIC COMPOUND $ZrCr_2$
Yuan-Shou Shen (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-6010

The zirconium-chromium phase diagram was investigated in the region between 40% and 85% chromium. The $ZrCr_2$ intermetallic compound which has been the source of some controversy was especially considered. It was found that $ZrCr_2$ transforms from the low temperature C-15 ($MgCu_2$, FCC) structure to the high temperature C-14 ($MgZn_2$, HCP) structure between 1550°C and 1600°C, just the opposite transformation from

previously reported results. X-ray diffraction and metallographic methods were used to determine that this transformation is a shear type transformation which occurs on the (111) plane along the [1$\bar{1}$2] direction. The shear mechanism involved in the transformation was determined as a sluggish martensitic transformation.
Dissert. Abstr.

N69-15111 Michigan Univ., Ann Arbor.
A STUDY OF THIN FILM MAGNETODIELECTRICS (TFM)
Rodger Michael Walser (Ph.D. Thesis) 1967 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-7754

The problem considered is the realization of a thin film medium that is penetrable by RF energy, has a large average magnetic susceptibility, and undergoes a ferromagnetic resonance that is similar to an individual thin film. To do this, a thin film magnetodielectric (TFM) is constructed. It consists of thin films that are uniformly arrayed, have a common anisotropy axis, and are suspended within an insulating medium. The intrinsic susceptibility of thin films is considered. The influence of the common film domain configurations and of the easy axis dispersion upon the susceptibility is examined. The initial and gyromagnetic susceptibility spectra are then formulated from a solution to the equation of motion of the magnetization, for which a coherent rotation is assumed. Various methods to increase the penetration of films by electromagnetic waves are examined. The thin film magnetodielectric appears to be the most useful. The experimental techniques used for the vacuum deposition of the TFM and for determining its static and RF properties are discussed.
Dissert. Abstr.

N69-15112 Oklahoma State Univ., Stillwater.
INVESTIGATION OF ELASTIC DISTORTIONAL WAVE BIREFRINGENCE DUE TO CRYSTALLITE PREFERRED ORIENTATION AND STRESS IN ANISOTROPIC POLYCRYSTALLINE ALUMINUM
Raymond Leon Gause (Ph.D. Thesis) 1967 197 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 68-8402

Pertinent theoretical models were presented in order to predict the theoretical fractional velocity change which would be produced by preferential crystallite orientation and externally applied stress. Measurements were made on specimens of the test material which had been cold-rolled to various reductions in gage to produce different orientations and residual stress distributions; preferred orientation determinations were made using X-ray diffraction techniques and were compared with measurements made of fractional velocity changes; external stresses were applied and the resulting birefringence was measured. The study involved two alloys of aluminum, 6061-T6 and 1100-0. From the results, there is no evidence that preferred orientation contributes significantly to the birefringence of shear waves in the two materials tested, whereas the stress-induced birefringence data show that stresses of reasonable magnitude can account for the observed birefringence.
Dissert. Abstr.

N69-15137 Rensselaer Polytechnic Inst., Troy, N. Y.
DYNAMICAL ASPECTS OF THE DEFORMATION OF A 6-CONSTANT CUBIC CRYSTAL
Vincent Xavier Kunukkasseril (Ph.D. Thesis) 1966 60 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 67-4182

The displacement equations of motion for a 6-constant centro-symmetric cubic crystalline material are developed. Also, the determinantal equations for velocities of plane elastic waves are developed. Previously determined elastic constants are used to calculate the phase velocities in various directions of a cubic crystal. Normal mode vibrations of cubes and infinite prisms are theoretically considered. Dilatational modes of these bodies are determined and they demonstrate that there are no couple-stress effects in these cases. Normal mode shapes and frequencies for the equivoluminal modes are obtained but without consideration of couple-stresses. Free vibration experiments were conducted on a two-dimensional model which was considered as a slice of an infinite prism and on a three-dimensional cubic model. Experimentally determined frequencies and mode shapes are studied in terms of the theoretical results.
Dissert. Abstr.

N69-15157 Missouri Univ., Columbia.
FIELD EFFECT DEVICE STUDIES FOR THIN FILM GALLIUM ARSENIDE
Tung Haiang Weng (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-3066

Producing a known carrier type and carrier density in gallium arsenide films by means of simultaneous evaporation of dopant and powdered gallium arsenide was achieved. Germanium was used as the dopant for producing P-type films and indium or tin was used for producing N-type films. When indium was used as the dopant, extreme care had to be taken in order to avoid the formation of gallium indium arsenide. The mobility of the doped films, measured by Hall effect, was in the vicinity of 1 cm^2/V-sec. Surface states on films deposited on a polished aluminum substrate were studied by MOS technique. The density of surface states was found to be in the range of 10^{12}–10^{13} states/cm^2-eV, which is about one order of magnitude higher than those of single crystal gallium arsenide. Surface states were found to dominate the operation of GaAs thin film transistors.
Dissert. Abstr.

N69-15159 Illinois Univ., Urbana.
PROPERTIES OF TELLURIUM- AND SULFUR-DOPED $GaAs_{(1-x)}P_x$ NEAR THE DIRECT-INDIRECT TRANSITION
Gregory Eugene Stillman (Ph.D. Thesis) 1967 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-8236

The temperature dependence of the Hall coefficient and of the resistivity of $GaAs_{1-x}P_x$ crystals heavily doped with S and Te have been measured throughout the entire alloy composition range and from 55°K to 400°K. It is shown that the two conduction band model can explain the observed results in Te-doped $GaAs_{1-x}P_x$ crystals for compositions out to $x \approx 0.34$, but for compositions larger than this, carrier freeze-out into deep levels associated with the subsidiary conduction band must be included. The electrical behavior of diffused p–n junctions in S-doped $GaAs_{1-x}P_x$ is explained in terms of the photoconductivity of the material. When S-doped $GaAs_{1-x}P_x$ is illuminated at low temperature (T<100°K), there is a large and persistent increase in carrier concentration and a corresponding decrease in the resistivity.
Dissert. Abstr.

N69-15187 Syracuse Univ., N. Y.
Si-GaAs HETEROJUNCTIONS
Thomas Lifu Huang (Ph.D. Thesis) 1967 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-5486

Using tellurium or silicon telluride as transport agent, n-type Si has been deposited on p-type and n-type GaAs substrates. Experimental results obtained from the resultant Si-GaAs n–p and n–n heterojunctions are consistent with abrupt heterojunction theory. All n–p units have typical rectification properties while, depending on the GaAs doping density, n–n units may exhibit rectification or double-saturation characteristics. With few exceptions, tunneling current appears to predominate in these devices. The junction capacitance is frequency-dependent. This is presumably a result of traps in the GaAs. Photovoltage reversal is observed in n–p units under forward bias, while optical modulation of current is observed in double-saturation n–n units.
Dissert. Abstr.

N69-15216# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

JUNCTIONS (n–p) OBTAINED IN SILICON BY ION IMPLANTATION [GIUNZIONI n–p OTTENUTE IN SILICIO MEDIANTE IMPIANTO DI IONI DROGANTI]

F. Fioroni, D. Fiori, R. Gislon, C. Papa, U. Spoglio et al 1968 22 p refs In ITALIAN

(RT/EL(68)11) Avail: CFSTI

Ion implantation experiments are described, and the measurements of irradiated samples for determining the junction characteristics are presented. The conclusion that n–p junctions are formed when silicon plates are irradiated with $^{11}B+$ or $^{31}P+$ is reached. Resistivity measurements of the sample layers reveal a profile of impurities. The interpretation of this profile dissociates the penetration from the amorphous type related to the effects of weak channelization. A preliminary conclusion indicates the actual working parameters of semiconductor detectors. Charts summarizing results are included: (1) conductivity as a function of depth, (2) concentration of charge carriers as a function of depth, and (3) intensity–voltage characteristics of a diode. Transl. by F.O.S.

N69-15258# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.

DEVELOPMENT OF VOIDS IN NICKEL DURING IRRADIATION

B. Mastel and J. L. Brimhall 20 Aug. 1968 8 p Presented at the 26th Ann. Meeting of the Electron Microscopy Soc. of Am., New Orleans

(Contract AT(45-1)-1830)

(BNWL-SA-1768-Rev; CONF-680905-2) Avail: CFSTI

Disks of high-purity Ni foil were annealed at 700°C for 1 hr in vacuum, cooled slowly, and irradiated at a constant temperature of 380°C after surrounding with a NaK mixture. Other disks were irradiated in He filled capsules at 400 to 450°C. Total neutron fluences for the two capsules were 5×10^{19} n/cm^2 and 4×10^{19} n/cm^2 (E > 1 MeV) respectively. Pores similar in size and shape were observed in both irradiated specimens, and determined to lie within the foil, but were absent in unirradiated control specimens. The pores, although not cubic, had definite geometric shapes, possibly octahedral. It is postulated that the pores did not develop from gas bubbles but were essentially empty pores, or voids, formed by coalesence of vacancies produced by displaced atoms. Annealing at 700°C for 2 hrs produced an inhomogeneous distribution of voids, and at annealing for 2 hrs at 800°C the voids disappeared. Dissert. Abstr.

N69-15286# Atomics International, Canoga Park, Calif.

GRAPHITE CRYSTAL GROWTH

S. B. Austerman, J. W. Wagner, and S. M. Myron 15 Aug. 1968 22 p refs

(Contract AT(04-3)-701)

(NAA-SR-12486) Avail: CFSTI

Graphite single crystals were grown by precipitation from carbon-saturated molten iron and nickel. They were grown with low nucleation and growth rates, under conditions of low supersaturation, using slow-cooling and steady-state thermal gradient methods. Crystals produced included thin platelets, up to 3 cm across and a fraction of a mm thick; tabular crystals, measuring several mm across, and a form not previously reported—columnar crystals, up to 2 mm long. Details of crystal characterization, including crystal morphology, cleavage, twinning, etching, dislocation geometry, and lattice distortions, were examined. The crystals most nearly approaching ideality were the columnar crystals. Those with the greatest amount of mosaic substructure were the thin platelets. The characterization details are correlated with growth conditions. From this work, it is concluded that, with sufficient attention to details and abundant patience, growth of high-quality graphite crystals with substantial size has been demonstrated to be feasible. Author (NSA)

N69-15293# Industrial Science and Technology Agency, Tokyo (Japan). Electrotechnical Lab.

MAGNETIC RESONANCE STUDY ON IMPURITY STATE IN n-TYPE SILICON

Shigeru Maekawa Jun. 1968 56 p refs In JAPANESE; ENGLISH summary *Its* Res. No. 684

Avail: CFSTI

Measurements of electron spin resonance (ESR) of n-type silicon crystals containing from 10^{16} to 10^{20} phosphorus atoms per cm^3 were made below 4.2°K, and at the microwave frequency of 10 GHz. In the low impurity concentration, $N_D - N_A$ is less than $1.7 \cdot 10^{18}$ cm^{-3}, spin resonance spectra coming from various kinds of electronic state, such as isolated donor atoms, isolated donor pairs, and interacting donor clusters, were clearly distinguished. The intensity of the resonance line associated with isolated donor pairs was measured as functions of temperature and impurity concentration. Donor electrons within the isolated pair are antiferromagnetically coupled with each other, and the exchange interaction energy was estimated over the concentration range from 10^{16} cm^{-3} and 10^{17} cm^{-3}. The donor pair grew up to donor clusters when the impurity concentration became higher. From the analysis of the shift of the resonance line position associated with donor clusters and the temperature variation of their resonance spectrum, it was estimated that there may exist weak ferromagnetic exchange interaction between donor pairs, or donor clusters. The width of the resonance line arising from these donor clusters became smaller with increasing donor concentration. The temperature dependence of the line width and microwave paramagnetic susceptibility was measured as a function of impurity concentration. It was concluded that the sharp resonance line originates from localized electrons with hopping motion. Author

N69-15356# General Electric Co., Cincinnati, Ohio. Missile and Space Div.

RADIATION DAMAGE IN VANADIUM

R. C. Rau, R. L. Ladd, and J. Moteff [1968] 3 p refs Presented at 26th Ann. Meeting of the Electron Microscopy Soc. of Am., New Orleans, 16–19 Sep. 1968

(Contract (AT(40-1)-2847)

(GEMP-612; CONF-680905-3) Avail: CFSTI

Microstructures of vanadium irradiated at ≈70°C to a fast neutron flux of $5 \mid 10^{19}$ n/cm^2 were studied by transmission electron microscopy before and after annealing. The observed defect clusters were found to be stable; this is ascribed to the interstitial impurities and their interaction with the defects. The circular halos of defect clusters around discrete particles are believed to be damage from the $^{10}B(n,\alpha)^7Li$ reaction. NSA

N69-15361 Ohio State Univ., Columbus.

CRYSTAL FIELD-SPIN ORBIT PERTURBATION CALCULATIONS FOR TRIGONAL BIPYRAMIDAL ENVIRONMENT

Clifford Andrew L. Becker (Ph.D. Thesis) 1967 300 p

Avail: Univ. Microfilms: HC $13.50/Microfilm $3.85 Order No. 68-8797

Attention has been directed at the combined crystalline field-spin orbit perturbation calculations for a d^1, d^9 and a d^2, d^8 electronic configuration subjected to a trigonal bipyramidal environment. The simple crystal field perturbation of the one-electron exponential (orbital) basis functions and the two-electron orbital eigenfunctions in the Russell–Saunders approximation has been investigated first and found completely expressable in terms of two parameters: the octahedral Dq and a new parameter of $\langle r^2 \rangle$. Calculations for distorted and pseudo trigonal bipyramidal environment are similar to those for the regular trigonal bipyramid and can be expressed in the ratios of the several bond lengths and in their reduced symmetry notation. Dissert. Abstr.

N69-15362 Lehigh Univ., Bethlehem, Pa.
STRUCTURE AND MAGNETIC PROPERTIES OF REACTIVELY PRESSURE SINTERED PURE AND DOPED YTTRIUM IRON GARNET
Douglas Andrew Koop (Ph.D. Thesis) 1967 114 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-4891

The reaction kinetics, magnetizations, and Curie temperatures of pure and doped yttrium iron garnet fabricated by conventional and pressure sintering techniques have been studied. The pure and doped garnets were reactively sintered from stoichiometric mixtures of the component oxides. The dopants (gadolinium, aluminum, and chromium) were chosen because of their preference for occupying various interstitial sites within the garnet lattice. The reaction kinetics show a marked enhancement when sintered under pressure due to higher initial particle compaction followed by increased diffusivity resulting from a higher concentration of plastically induced vacancies. The dopant ions have varying degrees of retardation on the reaction kinetics. These effects are discussed with reference to ionic sizes, electronic structures, and interstitial site preferences. Dissert. Abstr.

N69-15363 Oklahoma State Univ., Stillwater.
A REVERSIBLE NUCLEAR RADIATION APPROACH TO GENERATION-RECOMBINATION NOISE STUDIES IN Ge SINGLE CRYSTALS
Ed Raymond McCarter (Ph.D. Thesis) 1967 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-8455

Using 14.7 MeV monoenergetic neutrons and ^{60}Co gamma rays (1.17 MeV and 1.33 MeV), the lifetime of a germanium single crystal has been changed by a factor of 10^3, and the apparent doping changed from n to p. By annealing the crystals at temperatures up to 550°C, these crystal parameters have been restored to within 20 percent of their original value. The crystal physical dimensions and surface properties remained unchanged within the limits of measurement. A new type noise spectra has been found in gamma-irradiated crystals which, to the author's knowledge, has not been reported heretofore in the literature. Dissert. Abstr.

N69-15389# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF ELECTRON AND HOLE PROCESSES IN KCl-Ag CRYSTALS BY THE ELECTRON PARAMAGNETIC RESONANCE METHOD
L. A. Pung et al 5 Jan. 1968 10 p refs Transl. into ENGLISH from Tr. Inst. Fiz. i Astron., Akad Nauk Est. SSR (Tartu), no. 31, 1966 p 133–141
(AD-678474; FTD-HT-23-1532-67) Avail: CFSTI CSCL 20/2

A study was made of variations in the number of hole and electron coloration centers in KCl-Ag monocrystals irradiated at 77 degrees K by x-rays, as a function of the temperature of pulsed heating, using the electron paramagnetic method. The data obtained make it possible to obtain a specific conclusion on the sign of the observed stages of the relaxation process. TAB

N69-15418# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONLINEAR OPTICAL EFFECTS AND SPATIAL DISPERSION IN CRYSTALS
V. S. Mashkevich 21 Dec. 1967 12 p refs Transl. into ENGLISH from Akad. Nauk Ukr. SSR, Inst. Poluprovodnikov, Kventovaya Elektron., Tr. Resp. Seminara (Kiev), 1966 p 3–12
(AD-678393; FTD-HT-23-1187-67) Avail: CFSTI CSCL 20/2

The author considers frequency addition as a basis for explaining the effect which spatial dispersion of nonlocalized excitations has on nonlinear optic effects in crystals. An expression is derived within the framework of perturbation theory for the probability amplitude of the three-phonon process with resonance in intermediate states, and the case where exciton states are intermediate is considered. The proposed theory is applied to addition of focused and plane waves and possible instances of spatial dispersion are studied. TAB

N69-15439# Brookhaven National Lab., Upton, N. Y.
IRON SHIELDING FOR AIR CORE MAGNETS
J. P. Blewett [1968] 13 p Presented at the Conf. on Superconducting Devices and Accelerators, Upton, N. Y.
(BNL-12841; CONF-680621-12) Avail: CFSTI

The use of iron shielding for removing the high external magnetic fields around air-core superconducting magnets is considered. The field distribution around coils of infinitesimal thickness is treated and extended to coils of finite thickness. Field patterns for dipole fields and quadrupole fields are shown. Iron cross sections are discussed, and the distribution of stored energy in the various regions is approximated. NSA

N69-15467# Central Electricity Generating Board, Berkeley (England). Nuclear Labs.
OBSERVATION OF IMPURITY SEGREGATION WITHIN AN ARRAY OF PARALLEL DISLOCATIONS
J. T. Buswell Sep. 1968 9 p refs
(BD/B/N-1179) Avail: Issuing Activity

A field ion microscope study was made of an array of parallel dislocations, of mixed edge and screw character, in W. In the particular specimen studied, which had been irradiated to a fast neutron dose of 5.42×10^5 n/m^2 at 40°C, evidence was found for the segregation of impurities along the dislocation lines and in the plane between the dislocations. The observation is correlated with electron microscope evidence for the presence of such dislocation arrays in W. Author (NSA)

N69-15724# Comision Nacional de Energia Atomica, Buenos Aires (Argentina).
LONGITUDINAL MAGNETOMORPHIC EFFECTS IN LAMINAS OF In [EFECTO MAGNETOMORFICO LONGITUDINAL EN LAMINAS DE In]
F. de la Cruz, M. E. de la Cruz, and J. M. Cotignola 1968 17 p refs In SPANISH
(Grant NSF GP-3586)
(CNEA-217) Avail: CFSTI

Magnetoresistive effects in layers of indium .003 to .01 cm thick were investigated. Results agree with theoretical calculations based on free electron models. It is thus necessary to use the theories of Kohler, as modified by Olson, and to discount internal magnetoresistance. Correlation of experimental and theoretical data yielded values for electro-impulses and internal resistance. Also discussed is an analysis of the data obtained in Olson's copper experiments using Kohler functions, and subsequent applications of that data to the present work. The values of p b 1 obtained in this analysis, are based on the anisotrophies of the particle free drift (p b 1). Author

N69-15776# Pennsylvania State Univ., University Park. Dept. of Physics.
THERMAL CONDUCTIVITY OF SILICON IN THE BOUNDARY SCATTERING REGIME Interim Technical Report
Wilbur Scott Hurst Oct. 1968 174 p refs
(Contract Nonr-656(34))
(AD-678440; TR-5) Avail: CFSTI CSCL 20/12

Thermal conductivity measurements on high-resistivity single crystals of silicon were made in the phonon boundary-scattering regime. The conductivities of samples with rough surfaces had a nearly T to the 3rd power dependence, in close agreement with the theory of Casimir. The conductivity did not change with

different crystallographic rod faces for a given rod axis. However, the conductivity showed a strong dependence upon the crystallographic orientation of the rod axis of the sample, the conductivity of a sample having a (100) rod axis being nearly double that of an equal-sized sample with a (111) rod axis. In silicon, the phonon velocities are anisotropic, but it does not appear that the inclusion of the anisotropy in the Casimir formulation would be sufficient to explain this effect. For both rod axes, the change in conductivity with crystal dimensions is in agreement with the modified size-effect theory of Berman, Simon, and Ziman. For rough samples of rectangular cross-section, the effective diameter is the harmonic mean width rather than the geometric mean usually assumed. However, the conductivity deviates strongly from the T to the 3rd power law below 1.7K. Highly polished surfaces gave a large increase in conductivity, indicating largely specular reflection of the phonons. The temperature dependence was much less than cubic, indicating that the amount of specularity is wavelength dependent.
Author (TAB)

N69-15819# Joint Publications Research Service, Washington, D. C.
THEORY OF FIELD EMISSION IN SUPERCONDUCTORS
G. A. Gogadze et al [1968] 12 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 23, no. 4, 1967 p 606-615
(PB-179629T) Avail: CFSTI CSCL 20C

A distribution is derived of the electrons emitted from a superconductor based on its total energy and on its normal component. Both functions of distribution indicate an appreciable difference from the corresponding functions for standard metal in a confined range of energies near the Fermi level. At the same time, the complete variation of the autoelectronic current during the transition of the metal from normal state to a superconducting one is very slight. The calculation is based on utilizing the tunnel Hamiltonian method of Cohen, Falicov and Phillips.
Author (USGRDR)

N69-15847# Royal Aircraft Establishment, Farnborough (England).
RESOLVED SHEAR STRESS FOR SLIP AND TWINNING IN TITANIUM
P. G. Partridge and C. J. Peel. May 1968 38 p refs
(RAE-TR-68110) Avail: CFSTI

Curves of Schmid factors for twinning are presented for all $\{10\bar{1}2\}$ $<1011>$ systems, for tensile or compressive stress axes lying in $\{10\bar{1}0\}$ and $\{11\bar{2}0\}$ planes. The corresponding curves are also given of Schmid factors for basal and prism slip in the parent matrix and in any $\{10\bar{1}2\}$ twin. Pre-existing twins have little effect on the ability to slip on basal planes (for 59% of the stress axes considered) but when they do have an effect, it is more likely to be detrimental (ability to slip is decreased or increased for 25% and 16% of the stress axes respectively). When prism slip predominates however, twins enhance the ability to slip in the majority of orientations (57%). Slip is unaffected or decreased for 24% and 19% of the axes respectively. All twins nucleated under tensile stresses increase the ability to slip on prism planes, but twins nucleated have little effect on the ease of basal slip. When twins are nucleated under compressive stresses, no twins help prism slip, but some twins enhance basal slip. Twin boundaries act as barriers to slip in the $<11\bar{2}0>$ directions for the majority of orientations considered. Twinning therefore reduces the effective grain size and may thereby increase both the rate of work hardening and the ductility.
Author (ESRO)

N69-15956# Joint Publications Research Service, Washington, D. C.
SOVIET SCIENTIFIC DEVELOPMENTS: MAGNETOHYDRODYNAMICS; COMPUTER FIELDS MHD PRINCIPLE GENERATOR
2 Jan. 1969 3 p Transl. into ENGLISH from Ekon. Gaz. (Moscow), no. 48, Nov. 1968 p 40
(JPRS-47167) Avail: CFSTI

In connection with producing a magnetohydrodynamic generator capable of economical operation, a computer study was made of the behavior of a plasma cylinder in a magnetic field. The study verified that the cylinder, under normal conditions, must expand and gradually cool, but also discovered the occasional existence of a self sustaining high temperature plasma layer, called the T layer. The practical application of this T layer in an MHD generator, and its contribution to efficiency, is now under investigation. An aerodynamic furnace using a fan to replace fuel or electric heating elements as the heat source is also described.
A.C.R.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-15719*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
A STUDY OF HYDROGEN SLUSH AND/OR HYDROGEN GEL UTILIZATION. VOLUME 2: TEST PROGRAM 41.5-INCH DIAMETER TANK Final Report
31 Oct. 1968 140 p
(Contract NAS8-20342)
(NASA-CR-98935; K-11-68-1K-Vol-2) Avail: CFSTI CSCL 21I

This volume contains details and results of a subscale tank test program performed to advance the development of slush hydrogen technology for future space vehicle applications. Three different slush flow tests were performed during the program. Two were of approximately 48 hr duration while the duration of the third was approximately 12 hr. All were conducted without interruption, using two 12-hr shifts of test personnel per day. In the first flow test, the apparatus was subjected to an environmental heat load typical of cryogenic space vehicle groundhold operations in the Cryogenic Vehicle Flight Simulator. During the second and third flow tests, the simulator environment was modified to provide heat loads typical of ascent and orbit operations. The recirculation technique of loading and maintaining a tank with subcooled liquid and slush was demonstrated in all three flow tests. Also, in each of the three tests, predicted and measured flow characteristics were compared. liquid and slush mass and quality measurement accuracies were assessed, stratification effects were observed, and the overall system controllability and performance was evaluated. In the second and third tests, the effects of mixing and the characteristics of subcooled liquid drainage were observed.
Author

N69-15720*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
A STUDY OF HYDROGEN SLUSH AND/OR HYDROGEN GEL UTILIZATION. VOLUME 1: SATURN S-IVC MANNED MARS FLYBY VEHICLE APPLICATION STUDY Final Report
31 Oct. 1968 76 p refs
(Contract NAS8-20342)
(NASA-CR-98936; K-11-68-1K-Vol-1) Avail: CFSTI CSCL 21I

Details and results of an analytical vehicle systems study are reported in this volume. The study was undertaken to investigate the use of triplepoint liquid and slush hydrogen in the three propulsive stages of a Saturn S-IVC manned Mars fly-by orbital launch vehicle. The baseline vehicle design and analysis had been previously developed and reported. Summarized results of the S-IVC vehicle systems study are presented in Table 1-1. These data show that manned spacecraft payload weights for the S-ICV OLV can be significantly increased by use of subcooled liquid and slush hydrogen fuels in the three propulsive stages. For example,

spacecraft weights obtainable with use of triplepoint liquid and 50-percent slush are 5.285 kg (11.650 lb) and 5.829 kb (12.850 lb) greater, respectively, than that obtainable with use of 11.2 N/cm^2 (16.2 psia) saturated liquid. These respective increases in terms of percent are 6.45 and 7.12. The nominal spacecraft weight that would result from use of 11.2 N/cm^2 (16.2 PSIA) saturated liquid can be seen in the table to be 81.920 kg (180.600 lb). Author

N69-15757*# Aerojet-General Corp., Sacramento, Calif. Propulsion Div.
SYSTEM ANALYSIS OF GELLED SPACE-STORABLE PROPELLANTS Summary Report
Jul. 1968 174 p refs
(Contract NAS7-473; Proj. SA-1)
(NASA-CR-98932; Rept-1038-02S; Rept-43234T) Avail: CFSTI CSCL 21I

A rapid condensation method for the preparation of fine particles of chlorine trifluoride is described. These fine particles were used to get liquid nitrogen and liquid oxygen difluoride. Ten pounds of liquid oxygen difluoride gelled with solid chlorine trifluoride was prepared. The structure index and flow properties of these gels were measured. These gels exhibited extensive shear thinning with increasing shear rate. Within the limits of the tests performed, the OF_2/ClF_3 gels appear to be chemically and mechanically stable. It was found that liquid nitrogen gelled with solid chlorine trifluoride posseases static and dynamic flow properties which closely approximate those of the OF_2/ClF_3 gels. It was concluded that, N_2/ClF_3 gels may be used as suitable simulants for OF_2/ClF_3 gels. Author

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-15475*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ROCKET ENGINE EVALUATION OF EROSION AND CHAR AS FUNCTIONS OF FABRIC ORIENTATION FOR SILICA-REINFORCED NOZZLE MATERIALS
Donald A. Peterson, Jerry M. Winter, and Arthur M. Shinn, Jr. Washington Jan. 1969 43 p refs
(NASA-TM-X-1721) Avail: CFSTI CSCL 21H

Thirty-five silica reinforced ablative specimens were evaluated. Quartz reinforcement was determined to have the greatest resistance to erosion, but a low cost silica powder-filled material was also high in erosion resistance. A fabric orientation of 60° to the nozzle centerline resulted in low char depth and high erosion resistance. The fabric layup angle to the gas stream should be minimized to minimize char depth and reduce engine weight. A 0° helix angle used for rosette layups resulted in delaminations and severe erosion. Author

N69-15509# Los Alamos Scientific Lab., N. Mex.
USE OF HYBRID SIMULATION TECHNIQUES IN THE NUCLEAR ROCKET PROPULSION PROGRAM
Hugh S. Murray, Charles P. Milich, Thomas E. Springer, and J. Douglas Balcomb 1968 12 p Presented at the Conf. on Analog Computation and Hybrid Simulation, Saclay, France
(Contract W-7405-ENG-36)
(LA-DC-9642; CONF-680925-1) Avail: CFSTI

The hybrid analog-digital computer facility used to predict the dynamic behavior of nuclear rocket propulsion systems is described. The use of the facility for generation of heat exchange properties of the hydrogen propellant is illustrated. NSA

N69-15862 Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
STUDY OF AN OPTIMAL SOLUTION OF A STATOREACTOR WITH FIXED GEOMETRY OF 3-7 MACH WITH SUBSONIC AND THEN SUPERSONIC COMBUSTION [RECHERCHE D'UNE SOLUTION OPTIMALE DE STATOREACTEUR A GEOMETRIE FIXE DE MACH 3 A MACH 7 AVEC COMBUSTION SUBSONIQUE PUIS SUPERSONIQUE]
Roger Marguat and Charles Huet [1968] 32 p refs In FRENCH Presented at AFITAE 5th Appl. Aerodyn. Colloq., Poitiers, France, 6-8 Nov. 1968
Avail: Issuing Activity

The search for an optimal solution of a ramjet booster in the Mach region 2.5 to 7 leads to variable geometry inlets and exhaust nozzles. Such solutions are technically so complicated that they cannot be used in practice. The possibility was studied of using successively subsonic and subsequently supersonic combustion in the same chamber with fixed geometry. The performance of such motors is close to the variable geometry optimal solution. The interest in such a fixed geometry engine, its general features, as well as the most suitable fuel are all explained. Performance advantages are presented of using such an engine closely integrated with a wing. Author

N69-15949# Communication Satellite Corp., Washington, D. C.
ACHIEVEMENT OF SYNCHRONOUS, EQUATORIAL ORBIT BY ELECTRIC PROPULSION
Ranjan Ghosh 19 Apr. 1968 58 p refs
(CL-5-68; PB-179472) Avail: CFSTI CSCL 21C

A preliminary analytical study was made of the feasibility of electric propulsion to transfer a communications satellite from a low circular orbit, with an inclination to the equator, to the synchronous, equatorial orbit. The dynamics of orbit raising and plane change when using a low thrust, the salient features of electric propulsion and the optimization of such a system was analyzed. A considerable gain in payload can be achieved by using electric propulsion at the cost of a long mission time. The optimum specific impulse of such a system is in the range of 800 to 2000 seconds, which is lower than what had been expected. Author (USGRDR)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-15022 Kodaikanal Observatory (India).
CALCIUM FLOCCULI AS AN INDEX OF SOLAR ACTIVITY
P. P. Kuriyan 18 Dec. 1967 14 p refs Its Bull. No. 172
Avail: Issuing Activity

Areas of calcium flocculi (plages) were measured from the Kodaikanal calcium spectroheliograms for the period 1906-1964. Yearly mean daily areas and areas in each quadrant were tabulated. The mean daily areas show a high correlation with the relative sunspot number and the mean daily areas of sunspot. The east-west asymmetry of the calcium flocculi is discussed. Author

N69-15084 Minnesota Univ., Minneapolis.
APPLICATION OF AN INTEGRATING TYPE IONIZATION CHAMBER TO MEASUREMENTS OF RADIATION IN SPACE
Sharad Ramchandra Kane (Ph.D. Thesis) 1967 220 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 68-7338

An integrating type ion chamber experiment, using a resetting drift-type electrometer and designed to fly on the OGO-I and III satellites is described. The chamber is demonstrated to have an accuracy and stability of ≅1% during its operation in space over a period of nearly three years. The minimum energy for penetration by protons and electrons is 12 and 0.6 MeV respectively. The response to 40 KeV electrons (through bremsstrahlung) is about 10^{-7} x response at energies >600 KeV). The response to X-rays in 10–150 KeV range is peaked at ≅ 20 KeV; below 10 KeV the response is ≅10^{-2} x (response at 20 KeV). For 1 particle cm^{-2} sec^{-1} of 20 KeV photons, electrons with energy ≥1 MeV, and minimum ionizing nuclei with charge Ze the pulsing rate of the chamber is respectively, 0.2, 7.0, and 5.5 Z^2 NPPS (Normalized Pulses Per Second) × 10^3. The OGO-I and III ion chamber measurements reported cover the period 10 September, 1964–2 July, 1966, a period following the minimum in solar activity. Dissert. Abstr.

N69-15555*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MICROWAVE AND HARD X-RAY BURSTS FROM SOLAR FLARES
Stephen S. Holt and Reuven Ramathy (NAS-NRC) Dec. 1968 52 p refs
(NASA-TM-X-63433; X-611-68-497) Avail: CFSTI CSCL 20H

Detailed theories of gyro-synchrotron emission and absorption in a magnetoactive plasma, X-ray production by the bremsstrahlung of non-thermal electrons on ambient hydrogen, and electron relaxation in a partially ionized and magnetized gas are applied to the solar flare burst phenomenon. The hard X-ray and microwave bursts are shown to be consistent with a single source of non-thermal electrons, where both emissions arise from electrons with energies $<mc^2$. Furthermore, the experimental X-ray and microwave data allow deduction of electron distribution properties, values of the ambient magnetic field, hydrogen density, and size of the emitting region. The proposed model, although derived mostly from observations of the 7 July 1966 flare, is shown to be representative of this type of event. Author

N69-15559# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
A COMPUTER VIDEO SYSTEM FOR SPACE RESEARCH AND FLARE FORECASTING
Thomas J. Janssens Nov. 1968 17 p
(ATR-69(8106)-1) Avail: Issuing Activity

A digital video magnetograph is described that digitizes, computes with, and immediately displays the computer results from television cameras running at approximately standard rates (3 MHz). Operation is based on scanning, digitization, subtraction of frames of alternate polarization, enhancement, and display. Results of image subtraction and enhancement of a prototype (Mod I) are presented, as well as the design of Mod II now under construction. A particular computation for the application to the measurement of solar magnetic fields are described. Input data for flare forecasting and a new development in flare forecasting using radio methods are discussed. A television camera used in this way approximates 40,000 parallel data channels using light from all points simultaneously instead of utilizing light from only one point at a time, resulting in high spatial and temporal resolution. The digital enhancement technique is an extension of signal averaging to two dimensions and gives high magnetic sensitivity. Author

N69-15692*# Maryland Univ., College Park. Inst. for Molecular Physics.
CORRELATION OF A SOLAR FLARE WITH A VISUAL AURORA
J. W. Meriwether, Jr., W. M. Benesch, and S. G. Tilford (Naval Res. Lab., Washington, D. C.) [Feb. 1968] 27 p refs Sponsored in part by NSF and AROD
(Grant NGL-21-002-008)
(NASA-CR-99119) Avail: CFSTI CSCL 04A

On February 13, 1967 at 1746 UT, the brightest flare of that year erupted from the surface of the sun. Approximately 56 hours later, the sudden commencement of a magnetic storm was recorded by many observatories around the world. Midway between the worldwide sudden commencement and the termination of the magnetic storm, there occurred at Ft. Churchill an aurora attaining nearly IBC III and an accompanying local negative magnetic bay. Measurements were made on this aurora as one of a series investigated with a multiple channel photometer simultaneously recording ten wavelength bands. A detailed examination of its emission structure has turned up a number of deviations from other aurorae studied. These include an unusual amount of λ6300 intensity and an increase in the apparent vibrational temperature of the molecular nitrogen that correlates well with the increase in the λ6300 emission. Author

N69-15693# Pennsylvania State Univ., University Park. Radio Astronomy Observatory.
SOLAR RADIO FLUX OBSERVED AT UNIVERSITY PARK, PENNSYLVANIA, OCTOBER–DECEMBER 1967
John P. Hagen Aug. 1968 40 p
(Grant NSF GA-720)
(SR-015) Avail: Issuing Activity

This report contains solar radio flux data recorded at 10700 Mc/s, 2700 Mc/s, 960 Mc/s and 328 Mc/s during the quarter 1 October 1967 to 31 December 1967. Author

N69-15703*# Volt Information Sciences, Inc., Washington, D. C.
MEASUREMENT OF PROTON AND NEUTRON SPECTRA ON SATELLITES OF THE KOSMOS SERIES
V. E. Dudkin et al Greenbelt, Md. NASA. Goddard Space Flight Center 10 Jan. 1969 7 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 6, no. 6, 1968 p 887–891
(Contract NAS5-12487)
(NASA-CR-99120; ST-PF-NE-10795) Avail: CFSTI CSCL 20H

The results of measurements of fluxes and energy spectra of protons and neutrons in satellites of the Cosmos series are considered. Measurements were conducted with the help of stacks of nuclear emulsions. The results thus obtained are used for the calculation of cosmic radiation doses. Author

N69-15815*# California Inst. of Tech., Pasadena.
PRIMARY COSMIC-RAY ELECTRONS BETWEEN 17 MeV AND 1 GeV IN 1967
Martin H. Israel [1968] 29 p refs
(Grant NGL-05-002-007)
(NASA-CR-99182) Avail: CFSTI CSCL 20H

Observations made from three balloon-borne detector flights from Fort Churchill, Manitoba on 17 June, 2 July, and 21 July are reported. The detector, consisting of a scintillation counter telescope, gas Cerenkov counter, and spark chamber with lead plates, floated near 2 g/cm^2 atmospheric depth for a total of 35 hours. The primary electron results depend critically upon the correction which is made for atmospheric secondary electrons. Data gathered during balloon ascents enables verification of a previously published calculation of atmospheric secondaries. At energies below 350 MeV, the observed electron flux can be entirely accounted for by atmospheric secondaries. Upper limits of 2 σ on the primary electron flux of 20, 9, and 13 electrons/m^2 sec ster are given in the

energy intervals 17–57, 57–112, and 112–374 MeV respectively. Between 374 and 1060 MeV, 16 ± 14 electrons/m^2 sec ster are found. Comparison between the observed upper limits to the primary flux and a calculation of the flux of galactic secondary electrons indicates an absolute solar modulation of electrons below 100 MeV by at least a factor of three. Author

N69-15908*# California Inst. of Tech., Pasadena.
COSMIC-RAY NEGATRON AND POSITRON SPECTRA BETWEEN 12 AND 220 MeV
K. P. Beuerman, C. J. Rice, E. C. Stone, and R. E. Vogt [1968] 12 p refs
(Grant NGL-05-002-007)
(NASA-CR-99198) Avail: CFSTI CSCL 20H

The interplanetary negatron and positron spectra from 12 to 220 MeV were determined with a balloon-borne magnetic spectrometer. The observed charge ratio $e^+/(e^+ + e^-) \approx 0.3$ indicates that the flux most likely consists of a mixture of primary negatrons and interstellar secondary negatrons and positrons. An absolute solar modulation of the interstellar positron flux was determined which decreases with decreasing magnetic rigidity below about 80 MV. Author

N69-15959 Institut d'Aeronomie Spatiale de Belgique, Brussels.
SOLAR ULTRAVIOLET RADIATION MEASUREMENT BY STRATOSPHERIC BALLOON [MESURE DU RAYONNEMENT ULTRAVIOLET SOLAIRE PAR BALLON STRATOSPHERIQUE]
M. Ackerman, D. Frimout, and R. Pastiels 1968 21 p refs In FRENCH; ENGLISH summary Presented at Belg. Soc. of Astron, Meteorol., and Phys. of the Globe, 23 Nov. 1968 Submitted for publication
(A-57-1968) Avail: CFSTI

The atmospheric optical window à 2000 Å is described and measurements of the solar radiation penetrating it are presented. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-15152# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
CANDIDATE EXPERIMENT SYSTEMS FOR FUTURE EARTH ORBITAL ASTRONOMY
W. L. Fischbein and L. L. Smith Dec. 1968 27 p refs
(RM-435) Avail: Issuing Activity

Key areas of astronomy research that are likely to play an important role in the earth orbital astronomy program expected for the 1974–1990 time period are identified. Six experimental designs are described, each representing a different region of the spectrum. These are: VLF (radio), IR, visible, UV, X-ray, and γ-ray instrumentation systems. All are of present state of the art and are at a level appropriate to an Apollo system. Briefly discussed is the probable competition expected from smaller scale systems in ground based, rocket, balloon, and small satellite research programs, where appropriate. A summary table is presented that describes 27 astronomy experiment systems representing all major areas of astronomical research, with minimal overlap. Included are estimated priority ratings for each system. Author

N69-15167 Stanford Univ., Calif.
SOME RESONANT AND NON-RESONANT PERTURBATIONS OF EARTH AND LUNAR ORBITERS
Juris Vagners (Ph.D. Thesis) 1967 177 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 68-6502

The research reported in this dissertation is concerned with the general area of long-term behavior of satellite orbits in the gravity field of an asymmetrical primary. Specifically, for near-earth orbiters analytical solutions are given for: (1) the long-period variations of the in-plane coordinates (radius, radial velocity and central angle) for ordinary non-resonant motion, and (2) the modified long-period behavior due to resonance with the longitude-dependent harmonics of the geopotential. Semi-analytical results are presented for the long-term motion of close lunar orbiters. In all these investigations use is made of the techniques of Hamiltonian mechanics and the von Zeipel procedure. Dissert. Abstr.

N69-15201*# Arizona Univ., Tucson.
COMMUNICATIONS OF THE LUNAR AND PLANETARY LABORATORY, VOLUME 7, PART 4
1968 71 p refs *Its* Commun. Nos. 123–126
(Grants NGL-03-002-002; NGR-03-002-081)
(NASA-CR-99008) Avail: CFSTI CSCL 03B

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2. ARIZONA–NASA ATLAS OF INFRARED SOLAR SPECTRUM, REPORT 2, NUMBER 124 G. P. Kuiper, D. P. Cruikshank, and L. A. Bijl p 197–220 refs (See N69-15203 05-30)

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4. A HIGH-RESOLUTION SOLAR SPECTROMETER FOR AIR-BORNE INFRARED OBSERVATIONS, NUMBER 126 D. P. Cruikshank, F. A. De Wiess, and G. P. Kuiper p 233–238 refs (See N69-15205 05-14)

N69-15202*# Arizona Univ., Tucson.
ARIZONA–NASA ATLAS OF INFRARED SOLAR SPECTRUM, A PRELIMINARY REPORT, NUMBER 123
Gerard P. Kuiper and D. P. Cruikshank *In its* Commun. of the Lunar and Planetary Lab., vol. 7, 1968 p 179–196 (See N69-15201 05-30)
Avail: CFSTI CSCL 03B

A sample (about 5%) of a set of photometric tracings of the infrared solar spectrum is shown obtained from the NASA CV-990 Jet during nine flights in July–August 1968. Two 12-inch telescopes were used, one feeding a 4.2-meter spectrometer of special design, the other LPL B-spectrometer. The 4-meter spectrometer records extend from 0.85 to 3.3 microns; the B-spectrometer records, from 0.85 to 5.1 microns. The 4.2-meter records between 0.85 to 0.97 microns are reproduced. Some runs were made in duplicate because of occasional troubles with the heliostat controls which account for the gaps in the records. The resolution is about 0.3 Å or 30,000 in the region shown. In the remaining 4.2-meter records the resolution varies from 20,000 to 60,000. In the preliminary paper, matching portions of the Michigan Atlas, "Photometric Atlas of the Near Infrared Solar Spectrum, λ8465 to λ25,243," are reproduced to facilitate comparisons of resolution and in particular to demonstrate the value of high-altitude flights in very nearly eliminating the telluric water-vapor spectrum. Author

N69-15203*# Arizona Univ., Tucson.
ARIZONA-NASA ATLAS OF INFRARED SOLAR SPECTRUM, REPORT 2, NUMBER 124
Gerard P. Kuiper, D. P. Cruikshank, and L. A. Bijl *In its* Commun. of the Lunar and Planetary Lab., Vol. 7, 1968 p 197–220 refs (See N69-15201 05-30)
Avail: CFSTI CSCL 03B

This paper is a continuation of N69-15202 covering the interval λλ 10657–12857 Å. Author

N69-15204*# Arizona Univ., Tucson.
NASA ATLAS OF INFRARED SOLAR SPECTRUM, REPORT 3, NUMBER 125
Gerard P. Kuiper *In its* Commun. of the Lunar and Planetary Lab., Vol. 7, 1968 p 221–232 refs (See N69-15201 05-30)
Avail: CFSTI CSCL 03B

The region of the solar spectrum containing the ν_3 band of methane, λ 3.12–3.46 μ, is shown as it appears essentially freed from telluric water vapor. Records taken with both the B- and the 4-meter spectrometer are included. The 4-meter results are somewhat degraded by a modulation due to filter interference and are regarded provisional. The Coriolis fine structure for some of the rotational lines is resolved. The remarkable paucity of solar absorption lines in this region is noted. Author

N69-15267# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON SPACE ORBITS
19 Dec. 1967 10 p Transl. into ENGLISH from Sov. Rossiya, 4 Jun. 1967 p 4
(AD-678408; FTD-HT-23-1555-67) Avail: CFSTI CSCL 22/2

Discussion of two artificial satellites orbited for purposes of meteorological observation which, together with data reception, processing and distribution points, form the experimental space meteorological system meteor. The mutual position of the orbits of the satellites is selected so that they accomplish weather observations over each region of the earths sphere at intervals of approximately 6 hours. This enables pursuit of the development of atmospheric process in the various areas and creates the possibility of obtaining and processing meteorological data from half the surface of the earth within a period of 24 hours. The complicated problem of processing the data is solved with the aid of a ground control complex. Telemetrical information is put into rapidly operating electronic computers. Practically immediately after communicating with the satellites computers complete the processing of all telemetered data, edit it and transmit it in form suited for use. Author (TAB)

N69-15272# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DARK CURRENT AND COLD EMISSION IN ELECTROOPTICAL CONVERTERS
P. V. Shchegiov 8 Jan. 1968 10 p refs Transl. into ENGLISH from Soobshch. Gos. Astron. Inst. (Moscow), no. 126, 1963 p 56–65
(AD-678405; FTD-HT-23-1461-67) Avail: CFSTI CSCL 3/1

An evaluation is made of the maximum value for dark current (thermo-ion emission of the photocathode and cold emission) of an image converter tube used in astronomy. Author (TAB)

N69-15275# Observatorio de Cordoba (Argentina).
ARGENTINA ASTRONOMY ASSOCIATION, BULLETIN NO. 13 [ASOCIACION ARGENTINA DE ASTRONOMIA, BOLETIN NO. 13]
L. A. Milone, ed. 1968 34 p refs In SPANISH Supported in part by Consejo Nacl. de Invest. Cienc. y Tec.
Avail: CFSTI

Resumes of the projects discussed at the reunion of the Association of Astronomy on 13 August 1967 are presented. Included are articles on: (1) solar radiation, (2) photoelectric and spectroscopic studies, and (3) status of various programs. Transl. by F.O.S.

N69-15385*# Smithsonian Astrophysical Observatory, Cambridge, Mass.
AN ANALYSIS OF THE PECULIAR A STAR HD 204411
W. L. W. Sargent (Mt. Wilson Obs.), K. M. Strom, and S. E. Strom Dec. 1968 28 p refs
(Grant NGR-22-024-001)
(NASA-CR-99083; Rept-810-54) Avail: CFSTI CSCL 03B

Well-widened, high-dispersion spectra were used to obtain the identifications and equivalent widths for over 1500 lines between 3700 Å and 4900 Å for the relatively cool Ap star, HD 204411. A model atmosphere analysis of these data was performed. The large number of lines used allowed a discussion and ruling out of any significant departures from LTE in the level populations for the lines, or any large variation of the turbulent velocity parameter with height. The results suggest a broadening of the Fe peak abundances, an overall enhancement of the Fe peak relative to H, and a decrease in the ratio of light element abundances to iron. The evidence also indicates that the s-process elements Sr and Zr have normal abundances relative to Fe. Author

N69-15490*# Volt Information Sciences Inc., Washington, D. C.
ON RELATIONSHIP OF SPORADIC RADIO EMISSION REGISTERED ON SATELLITES OF THE "ELEKTRON" SERIES WITH THE GEOMAGNETIC ACTIVITY
E. A. Benediktov et al 22 Jan. 1968 6 p refs
(Contract NAS5-12487)
(NASA-CR-99105; ST-PR-GM-10801) Avail: CFSTI CSCL 03B

The relationship between the sporadic radio emission and the geomagnetic disturbances is established as a function of the disposition of orbits of Elektron 2 and Elektron 4 satellites. Author

N69-15513*# Volt Information Sciences Inc., Washington, D. C.
THE ROLE OF ELECTRON IMPACT IN DESTRUCTION OF CARBON MONOXIDE MOLECULES ON THE SUN
A. P. Sarychev and G. V. Sitnik 8 Jan. 1969 6 p refs Transl. into ENGLISH from Astron. Zh. (Moscow), v. 45, no. 6, 1968 p 1303–1305
(Contract NAS5-12487)
(NASA-CR-99106; ST-SP-ACH-10794) Avail: CFSTI CSCL 03B

The rate is estimated of carbon monoxide (CO) molecule dissociation by electron impacts in the upper layers of the solar photosphere on the basis of the results of experiments on the collision of electrons with molecules. Comparison of this rate with those of photodissociation and dissociation at collisions with hydrogen atoms shows that the electron collision plays practically no significant role in the destruction of CO molecules on the Sun. Author

N69-15527*# Volt Information Sciences, Inc., Washington, D. C.
SIXTH START TO VENUS
14 Jan. 1969 1 p Transl. into ENGLISH from Pravda (Moscow), 11 Jan. 1969
(Contract NAS5-12487)
(NASA-CR-99103; ST-PR-LPS-10799) Avail: CFSTI CSCL 22A

A news release is presented dealing with the launching of AIS Venera 6 on 10 January 1969. Scientific investigations will be conducted concomitantly with AIS Venera 5 launched on 5 January 1969 to study the planet Venus. Verna 6 will reach planet Venus in the middle of May 1969. According to telemetric information, the onboard apparatus of both interplanetary stations operated normally. The guidance is performed from the Center of Long Range Space Communications. The incoming information is processed by the Coordinating Computation Center. B.P.

N69-15549# Stanford Univ., Calif. Inst. for Plasma Research.
PLASMA PHYSICS AND RELATED TOPICS IN ASTROPHYSICS Final Report, 1 Dec. 1963–1 Aug. 1968
P. A. Sturrock Aug. 1968 11 p refs
(Contract AF 49(638)-1321)
(AD-677314; SU-IPR-257; AFOSR-68-1890) Avail: CFSTI CSCL 3/2

This research has been concerned primarily with plasma phenomena of solar physics. Some phenomena of general interest have been studied; some of the solar problems involve plasma physics in only a minor way. However, the central theme of the research program has been the study of solar flares, solar radio bursts, and of structures such as filaments and streamers (all of which involve plasma processes), and the development of plasma physics theories to help understand these and related phenomena.
Author (TAB)

N69-15569 Arizona Univ., Tucson.
TRANSFORMATIONS AND DISCONTINUITIES FOR OPTIMAL SPACE TRAJECTORIES
Joseph David Mason (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-8308

The scope of the calculus of variations is extended to include problems with many subarcs which may be arranged in a variety of ways. Several subarcs may occur on the same interval of the independent variable or there may be an interval on which no subarc occurs while on either side of this interval subarcs do occur. Necessary minimizing conditions for this problem are derived from the classical Bolza problem by transforming the original problem into a Bolza problem with an expanded set of state and control variables. Minimizing conditions are stated for the Bolza problem and then transformed back into the original notation. Optimal swingby maneuvers for continuous thrusting rockets are analyzed and examined numerically. The swingby portion of the overall trajectory is replaced by a corner at which the effects of the swingby are introduced instantaneously. A flyby mission to Saturn is presented with no swingby, with a swingby at Jupiter and with a swingby at Mars.
Dissert. Abstr.

N69-15591*# Martin Co., Denver, Colo.
BUOYANT VENUS STATION MISSION FEASIBILITY STUDY FOR 1972 AND 1973 LAUNCH OPPORTUNITIES. VOLUME 2: TRAJECTORY ANALYSIS FOR 1972 AND 1973 MISSIONS Final Report
Donald W. Marquet and Charles E. French Washington NASA Jan. 1969 145 p refs
(Contract NAS1-7590)
(NASA-CR-66725-2) Avail: CFSTI CSCL 22C

Results are summarized of the trajectory analyses that were performed parametrically in support of the buoyant Venus station (BVS) mission study. The range of parameters were related to three reference missions that served as the baselines for the detailed BVS system design studies. The three reference missions are: 1972 flyby; 1973 orbital; and 1973 Venus/Mercury swingby. Parametric data are presented in the following technical area: (1) launch vehicle performance and launch period selection; (2) direct mode targeting; (3) orbit mode targeting; (4) orbit selection criteria; (5) entry environment; and (6) balloon deployment and drop sonde trajectory. A detailed mission profile is presented for each of the three reference missions. Use of the parametric data permits construction of mission profiles other than those detailed.
Author

N69-15597#
DIFFUSION OF RADIATION IN A NONSTATIONARY MEDIUM
I. N. Minin [1968] 9 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Mat., Mekh. i Astron. (Leningrad), no. 4, 1968 p 152–160
Avail: CFSTI

Nonstationary radiation diffusion processes are studied in a medium with variable optical properties. Solutions were reinvestigated for the case of a one-dimensional, semi-infinite medium with isotropic scattering, at each of whose points the optical depth changes exponentially with time. The probability of a quantum being reflected from the medium in a given time span was determined by Laplace transformations.
B.P.

N69-15623 California Univ., Los Angeles.
RECURSIVE NAVIGATION AND GUIDANCE FOR THE MIDCOURSE PHASE OF ORBITAL RENDEZVOUS
Charles Robert Welti (Ph.D. Thesis) 1967 266 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.45 Order No. 68-7494

Recursive filtering theory is applied to navigation and guidance for the midcourse phase of orbital rendezvous. Emphasis is placed on a self-contained on board system and a simplified technique for determining maneuver schedules. The analytical investigations consist of a simplified linearized error analysis and a "real world" simulation, both of which are formulated in a target centered rotating coordinate system. An approximate solution of the rendezvous equations is used in the error analysis. The solution is first order in relative distance and assumes a circular target orbit. It is assumed in the error analysis that the perturbing accelerations on the interceptor and target due to the effects of the earth's oblateness, gravitational anomalies, and atmospheric drag are nearly equal because the distance between the vehicles is specified to be small. Kalman filtering is incorporated into both the error analysis and "real world" simulation. This recursive filtering provides an optimum estimate of the relative state vector using tracking data.
Dissert. Abstr.

N69-15677*# Volt Information Sciences, Inc., Washington, D. C.
RADIATION AND REFLECTIVITY OF VENUS IN DECIMETER WAVES
G. M. Strelkov Greenbelt, Md. NASA Goddard Space Flight Center 17 Jan. 1969 9 p refs Transl. into ENGLISH from Astron. Vestn. (Moscow), v. 2, no. 1, 1968 p 19–23
(Contract NAS5-12487)
(NASA-CR-99109; ST-LPS-RA-10798) Avail: CFSTI CSCL 03B

A two-layer model is proposed for the structure of Venus' upper mantle, which would explain a series of experimental data related to its radioemission in decimeter waves. The two-layer structure is also in agreement with the low values of Venus' reflection factor (~1%), measured in the 3.6 cm wavelength. It is noted that a good physical analogue of the considered model may be the sand desert.
Author

N69-15694*# Volt Information Sciences Inc., Washington, D. C.
RADIATION OF VENUS NEAR lambda 1.35 cm [IZLUCHENIYE VENERY VBLIZI lambda 1.35 cm]
G. M. Strelkov Greenbelt, Md. NASA Goddard Space Flight Center 14 Jan. 1969 18 p refs Transl. into ENGLISH from Astron. Vestn. (Moscow), v. 2, no. 4, 1968 p 217–228
(Contract NAS5-12487)
(NASA-CR-99136; ST-LPS-RA-10796) Avail: CFSTI CSCL 03B

The results are of theoretical calculations of spectral characteristics of Venus' brightness temperature T in the λλ 0.75–165 cm band, and of investigations of the planet's radioemission peculiarities due to the presence of water in the atmosphere. The results of experimental measurements of T in the indicated interval of λ values agree well with the data on the parameters of Venus' atmosphere obtained on VENERA-4. The dip in the planet's brightness temperature by λ 1.35 cm appears to be either smaller or equivalent to the precision of T measurements, which, in most cases is ±10%. Presented here also are the spectral characteristics of Venus' brightness temperature in the wavelength interval λλ 0.3–3.75 cm, determined by taking into account the results of measurements on VENERA-4.
Author

N69-15685*# Volt Information Sciences, Inc., Washington, D. C.
QUASI-ISOTROPIC APPROXIMATION OF GEOMETRIC OPTICS
Yu. A. Kravtsov Greenbelt, Md. NASA. Goddard Space Flight Center 13 Jan. 1969 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Fiz. (Moscow), v. 183, no. 1, 1968 p 74–76
(Contract NAS5-12487)
(NASA-CR-99133; ST-GEO-PP-10797) Avail: CFSTI CSCL 03B

This paper expounds a modified geometric optics method for the solution of Maxwellian equations based upon waves in isotropic medium, earlier developed by Rytov. The equation arrived at is useful for possible applications in radioastronomy and radiophysics. Author

N69-15689# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE EARTH-MOON FLIGHT PATH
Am. Trifonov et al 21 Dec. 1967 12 p Transl. into ENGLISH from Pravda, no. 79, 20 Mar. 1966 p 6 and no. 80, 21 Mar. 1966 p 41
(AD-678438; FTD-HT-23-1384-67) Avail: CFSTI CSCL 22/2

The Soviet automatic lunar vehicle Luna-9 was launched on 31 January 1966; on 3 February, at 21 hours 45 minutes 30 seconds Moscow time this station carried out a successful soft landing on the surface of the moon. On that same day, at 21 hours 49 minutes 40 seconds, historys first moon-to-earth radio communication session took place, followed on 4 February, at 4 hours 50 minutes, by the commencement of the transmission to earth of the first images of the lunar landscape. TAB

N69-15694 Wisconsin Univ., Madison.
THE LAW OF INTERSTELLAR REDDENING FOR HII REGIONS AND THE Ly-V COLORS OF THEIR EXCITING STARS
William Laurance Gebel (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-5306

The $H\alpha$ and $H\beta$ fluxes for 20 diffuse nebulae have been measured photoelectrically with a 2" f/3.8 telescope through interference filters of 10 A width. The continuum radio fluxes at 6 and 11 cm for 12 of these nebulae have been obtained using the 140 foot Green Bank antenna. The observational data, together with published radio continuum fluxes for the nebulae included in this study but not observed at Green Bank, have been combined to deduce the total interstellar extinction from a comparison of the observed radio to Balmer flux ratios with the theoretical ratio of free-free to recombination emissivities. By the Zanstra technique, a comparison between the radio fluxes of the nebulae and the apparent visual magnitudes of the associated exciting stars gives a measure of the color of the stars between the Lyman continuum and the visible. It is shown how these colors can be used to determine an effective temperature-spectral type relation for the early O stars when line blanketed model atmospheres become available. Dissert. Abstr.

N69-15702*# Techsran Corp., Glen Burnie, Md.
CONCERNING THE ORIGIN OF THE MAGNETIC FIELDS ON STARS AND IN INTERSTELLAR SPACE
Ludwig Biermann 1968 21 p refs Transl. into ENGLISH from Z. Naturforsch. (Tubingen), v. 5a, no. 2, 1950 p 65–71
(Contract NAS5-14826)
(NASA-CR-99130) Avail: CFSTI CSCL 03B

It is demonstrated that electric currents must flow in a plasma in stationary vortical non-mass-proportional forces, and that the electric currents arising in this manner generate magnetic fields of considerable strength in the interior of stars. The tendency of the radiatic toward the isothermal surfaces thereby required in the case of hydrostatic equilibrium arises; as, for example, if the total acceleration determining the pressure gradients possesses a component g^* with no potential. It is found that g^* values of the order of $1 cm/sec^2$ in the interior of stars cause magnetic fields of 10^3 G. The only case thus far analytically discussed (baroclinic rotation of the entire star) strongly confirms the conclusion, but does not lead to an interpretation of the form of the magnetic fields on the sun and on some presumably rapidly rotating stars. Hence two other possibilities are discussed from the qualitative standpoint. Author

N69-15846*# Volt Information Sciences, Inc., Washington, D. C.
FROM HYPOTHESES TOWARD THE TRUTH
V. Prokof'yev 12 Jan. 1969 1 p Transl. into ENGLISH from Nedelya (Moscow), 12 Jan. 1969
(Contract NAS5-12487)
(NASA-CR-99104; ST-PR-LPS-10800) Avail: CFSTI CSCL 22A

Comments and conclusions based on observations of the planet Venus are presented. Radar measurements indicate that the planet rotates on its axis in approximately 250 terrestial days, while spectroscopic investigations of the cloud cover have yielded a rotation period of four to five terrestial days. If these two observations are true, it is concluded that winds of 100 m/sec prevail at the cloud level. The atmosphere is described in agreement with data of Venera-4. F.O.S.

N69-15886# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
DETERMINATION OF THE MEAN MOTION OF AN EARTH SATELLITE INDEPENDENTLY OF THE STATION COORDINATES ERRORS [OPREDELENIE SREDNEGO DVIZHENIYA ISKUSSTVENNOGO SPUTNIKA SPOSOBOM, NEZAVISIMYM OT POGRESHNOSTEI KOORDINAT MEST NABLYUDENIYA]
Ya. B. Zelinskii Oct. 1968 13 p refs Transl. into ENGLISH from Byul. Inst. Teor. Astron. (Leningrad), v. 10, no. 9, 1966 p 624–628
(AD-678352; ACIC-TC-1469) Avail: CFSTI CSCL 17/8

This paper discusses the methods of observations and calculations which make it possible to determine the mean motion of an earth satellite independently of the errors of the station coordinates. Satellites with large inclinations i must be observed near the topocentric equator. Satellites with small i must be observed near the meridian of the station. The method consists in combining the equations of conditions for two observations at the same station into one equation of condition. The tolerances are given for the observations of this type. Author (TAB)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-15228*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MARINER 4 AND 5 DISTURBANCE TORQUES AND LIMIT CYCLES, ADDENDUM
Daniel A. Prelewicz 15 Dec. 1968 320 p
(Contract NAS7-100)
(NASA-CR-88450; JPL-TR-32-1305) Avail: CFSTI CSCL 22A

Extensive examples are given of computer printouts that provide quantitative information on torque limits and limit cycles

affecting the Mariner 4 and Mariner 5 spacecraft during selected periods of flight. Information is presented in 4 selected plots with each plot showing reduced position data and torque limits vs. time. A.L.

N69-15229*# Applied Physics Lab., Johns Hopkins Univ. Silver Spring, Md.
GEOS-B ANTENNA SYSTEM
C. C. Kilgus Jul. 1968 124 p refs Sponsored in part by NASA (Contract NOw-62-0604-c)
(NASA-CR-98916; AD-677269; TG-977) Avail: CFSTI CSCL 09E

The report documents the design, performance, fabrication, and flight acceptance tests of the GEOS-B antenna system. Measured data are included for the VHF-UHF wideband hemispherical spiral, nine-port multiplexer, S-band conical spiral, and C-band cavity helices. Simple theoretical models are included to yield an intuitive insight to the theory of the system; a bibliography aids those seeking detailed information. Author (TAB)

N69-15329# Royal Aircraft Establishment, Farnborough (England).
UK3 SATELLITE MAGNETIC TEST PROGRAMME
A. Robbins Mar. 1968 92 p
(RAE-TR-68059/UL) Avail: CFSTI

Reasons are given why it is often necessary to specify and limit the magnetic moment of a satellite. The associated problems of low level magnetic field measurements are discussed and the method of applying these techniques to the UK3 satellite program is outlined. The results of the measurements show that after the flight models had been subjected to their full environmental test schedules quite large permanent moments were recorded. The relatively simple techniques by which these moments were reduced to acceptable levels are described. Finally an attempt was made to predict the spin axis precession of the UK3 satellite for various assumed values of magnetic moment and also to correlate the measured values with the observed spin axis motion during flight. The fact that little correlation was possible appeared to confirm that the magnetic moment of the F1 model was very low and that the disturbing torques were not of magnetic origin. Author

N69-15337# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RENDEZVOUS IN SPACE. HOW THE AUTOMATIC SATELLITES FOUND EACH OTHER IN ORBIT
Y. Marinin 6 Dec. 1967 8 p Transl. into ENGLISH from Pravda (Moscow), 2 Nov. 1967 p 3
(AD-678411; FTD-HT-23-1605-67) Avail: CFSTI CSCL 22/1

The report describes the first automatic docking of two Russian satellites - Cosmos-186 and Cosmos-187. TAB

N69-15374*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AN INVESTIGATION OF THE OPTIMUM DESIGN AND FLIGHT OF ROCKETS
John D. Bird Washington Jan. 1969 35 p refs
(NASA-TR-R-297) Avail: CFSTI CSCL 22D

An analysis using classical variational methods was made whereby significant physical characteristics of rockets were determined in an optimal sense. A two-point boundary value problem was formulated which, when solved, provided the significant physical parameters and flight path for a two-stage rocket which would deliver a given payload to orbit with minimum total initial mass. Numerical solutions were carried out for nine cases by an iterative method. The results show how the stage masses and thrusts should be proportioned for various structural efficiencies in the fuel tanks and rocket motors. Analyses of the type carried out for this investigation should be useful in the sizing and, generally, in the design of rockets. Author

N69-15417#
RADIO TELESCOPES SCAN THE EARTH
A. Obukhov et al [1969] 2 p Transl. into ENGLISH from Pravda (Moscow), No. 21(18434), 21 Jan. 1969

Cosmos 243, launched on 23 September 1968, was fitted with sensitive thermal radio radiation receivers to receive thermal radio emission from the earth. A brief discussion of this mission is presented. B.P.

N69-15421# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A SOLAR ARRAY MONITOR FOR GEOS-2
Daniel P. Peletier Aug. 1968 48 p refs
(Contract NOw-62-0604)
(AD-677274; APL-TG-1023) Avail: CFSTI CSCL 22/2

Anomalous solar array behavior on the GEOS-1 geodetic satellite (Explorer XXIX) nearly caused the loss of the satellites main battery. This incident prompted a decision to design and fly a device to monitor the solar array performance of the subsequent geodetic satellite (GEOS-2). The Solar Array Monitor (SAM) described in this memorandum is a solid-state device that integrates the current output of each of the three solar arrays aboard the GEOS-2 satellite. The three sets of integrated current data are telemetered to ground stations in digital form so that the solar array performance may be accurately and efficiently evaluated. The information provided by SAM, along with a judicious selection of satellite loads, offer a practical method of maintaining a healthy GEOS-2 power system. The 1% accuracy of the SAM allows more nearly ideal power budgeting. Thus, not only does the SAM help maintain an optimally functioning power system but also it increases the power available for useful work in the satellite. Results from data taken in orbit are presented and circuit design and performance are described. Author (TAB)

N69-15535# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE SPACE ARROW
A. Abukhov et al 22 Dec. 1967 7 p Transl. into ENGLISH from Pravda, no. 102, 12 Apr. 1967 p 3
(AD-678398; FTD-HT-23-1384-67) Avail: CFSTI CSCL 22/2

The thermal conductivity of a material is of paramount importance in space radiators when heat transfer is realized exclusively by radiation. The study deals with a method of solving steady-state radiative heat transfer when the thermal conductivity of a material depends on the temperature. A one-dimensional approximation was used in the analysis. Moreover, it was assumed that the fin had a constant thickness and that the heat transfer into the space was realized by radiation only; the effect of the fin and base surface was not considered. Under steady-state conditions, the heat emitted into space will be equal to the amount of heat flowing from the base surface to the fin base. TAB

N69-15590*# Martin Co., Denver, Colo.
BUOYANT VENUS STATION MISSION FEASIBILITY STUDY FOR 1972 AND 1973 LAUNCH OPPORTUNITIES. VOLUME 1: MISSION SUMMARY DEFINITION AND COMPARISON Final Report
John F. Baxter, Ronald E. Frank, John N. Froissad, and Gene R. Cody Washington NASA Jan. 1969 149 p refs
(Contract NAS1-7590)
(NASA-CR-66725-1) Avail: CFSTI CSCL 22A

Three mission modes and launch opportunities in which the buoyant station can be employed are considered: (1) a 1972 mission with a flyby spacecraft; (2) a 1973 mission with an orbiter spacecraft; (3) a 1973 mission in conjunction with a Mercury/Venus swingby opportunity. The buoyant station concept is found not to be highly sensitive to the mission mode selected. With minor differences, a station weighing approximately 400 lb at deployment (floating a 175-lb gondola/instrument package) is appropriate for each of the missions considered. A preliminary program plan for

the designated missions, including development program plans for the heat shield and the flotation system, is presented. Cost and schedule data are provided for each mission and for the development items. Author

N69-15592 *# Martin Co., Denver, Colo.
BUOYANT VENUS STATION MISSION FEASIBILITY STUDY FOR 1972 AND 1973 LAUNCH OPPORTUNITIES. VOLUME 3: CONFIGURATION DEFINITION. PART 1: CONFIGURATION Final Report
Patrick C. Carroll, Ronald E. Frank, and Jack D. Pettus Washington NASA Jan. 1969 451 p refs
(Contract NAS1-7590)
(NASA-CR-66725-3) Avail: CFSTI CSCL 22B

The buoyant station entry system is investigated to determine its compatibility with specified missions. A baseline capsule system —aeroshell, buoyant station, and subsonic probe— is defined. There are many points of similarity for all three missions considered. The configurations and the subsystem concepts are described to the depth necessary to identify major problem areas and to make comparisons between missions. Development of a balloon system, while a candidate for early effort, appears to be well within present technology. The heat shield development will, of course, be common for all Venus Probes. Author

N69-15593 *# Martin Co., Denver, Colo.
BUOYANT VENUS STATION MISSION FEASIBILITY STUDY FOR 1972 AND 1973 LAUNCH OPPORTUNITIES. VOLUME 3: CONFIGURATION DEFINITION. PART 2: APPENDICES Final Report
Allan R. Barger, H. Edward Sparhawk, John R. Mellin, Ronald E. Frank, Jack D. Pettus et al Washington NASA Jan. 1969 169 p refs
(Contract NAS1-7590)
(NASA-CR-66725-4) Avail: CFSTI CSCL 22

The model atmospheres used in this study were based on revised Mariner 5 and Venera 4 data. Heat shield design requirements were studied for the three entry modes; the baseline aeroshell configuration was selected as a spherically blunted 55° half-angle cone. A summary of ablative materials considered, shield thicknesses and weights, and material performances is presented. An assessment was performed on the modified Lunar Orbiter for Mars and Venus missions. Spacecraft modifications including the BVS capsule are summarized. A conceptual design of a TV drop sonde concept for use with the BVS is proposed. Dual altitude balloon missions were investigated. The design criteria, configurations, and concepts were analyzed. The BVS sterilization study resulted in an interpretation of the planetary quarantine analysis for Venus in terms of engineering criteria. The multipath environment considered in the design concept for a relay communication link between the BVS and the spacecraft is described. Doppler and ranging options are given for BVS position determination. B.P.

N69-15600 *# Martin Co., Denver, Colo.
STUDY OF A SOFT LANDER/SUPPORT MODULE FOR MARS MISSIONS. VOLUME 1: SUMMARY Final Summary Report
Raymond S. Wiltshire and Hugh E. Craig Washington NASA Jan. 1969 151 p refs
(Contract NAS1-7976)
(NASA-CR-66728-1) Avail: CFSTI CSCL 22B

The study results accomplished in Modification 3 to the Direct Venus Orbital Entry for Mars Mission Study are documented. The objective was to determine the conceptual design of an attitude stabilized soft lander capsule and to obtain solutions in the areas of communication, data handling, cost, reliability, weight, program implementation of long-lead items and the effective use of existing equipment. Specifically the study has: (1) investigated each subsystem to identify any critical long-lead items requiring funding; (2) established the minimum costs of the autonomous soft lander/support module configuration; (3) evaluated the applicability of current spacecraft hardware undergoing development to determine changes necessary to meet the mission requirements; (4) performed mission analysis to confirm communications link analysis for cruise, entry, and postlanding mission phases; and (5) developed conceptual design of the attitude stabilized soft lander capsule with its separable support module. Author

N69-15601 *# Martin Co., Denver, Colo.
STUDY OF A SOFT LANDER/SUPPORT MODULE FOR MARS MISSIONS. VOLUME 2: SUBSYSTEMS STUDIES Final Summary Report
Raymond S. Wiltshire, Michael Kardos, Melvin W. Kuethe, Ralph H. Dergance, Roger T. Schappell et al Washington NASA Jan. 1969 233 p refs
(Contract NAS1-7976)
(NASA-CR-66728-2) Avail: CFSTI CSCL 22B

The results are summarized of all the subsystem trade studies and analyses performed during the study. The alternative configuration effect, where applicable, is discussed. Sample acquisition, subsurface temperature and moisture probe, moisture detection, biology instrumentation, and radioisotope heater environmental effects are described. The totally sterilized module configuration is discussed. All the propulsion components of their parameters are presented. The justification of the suggested lunar module (LM) radar changes is given. Additional data are provided on the applicability of current components in the guidance and control subsystem. A single telemetry system was selected to perform all the telemetry processing and formatting functions required during all mission phases. The power and pyrotechnic section provides the total power requirements for each phase of the mission and a description of the hardware implementation. The thermal control computer program and the temperature results it provided are presented. The environments for each mission phase are given and the thermal control system performance shown. Author

N69-15602 *# Martin Co., Denver, Colo.
STUDY OF A SOFT LANDER/SUPPORT MODULE FOR MARS MISSIONS. VOLUME 3: APPENDICES Final Summary Report
Michael K. Mann, Billie W. Preston, and Parker S. Stafford Washington NASA Jan. 1969 298 p refs
(Contract NAS1-7976)
(NASA-CR-66728-3) Avail: CFSTI CSCL 22B

The results of a detailed study of the applicability of the LM radar to the Mars soft lander mission are documented. It was conducted through the use of small digital programs in conjunction with an extensive six degree of freedom simulation of the vernier descent and landing phase. A summary of the results with recommended radar changes and guidance and control system changes is presented. Next, a discussion of the vernier descent guidance laws and control system stability is given. Following that, a description of the radar mathematical models used in this study is presented. Two detailed sections are then presented documenting the various analytical results and most of the six degree of freedom simulation runs. Author

N69-15634 *# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
RESEARCH PROBLEMS IN ATMOSPHERE ENTRY AND LANDING FOR MANNED PLANETARY MISSIONS
C. A. Syvertson Washington Jan. 1969 34 p refs Presented at the AIAA Technol. for Manned Planetary Missions Meeting, New Orleans, 4-6 Mar. 1968
(NASA-TN-D-4977) Avail: CFSTI CSCL 22A

Some of the research problems associated with atmosphere entry for manned planetary missions are assessed with primary emphasis on the problems related to missions to Mars and Venus.

The assessment is divided into two parts: First, the requirements associated with entering the Earth's atmosphere are defined, and second, those associated with atmosphere entry and landing at the target planet are considered. The assessment of the problems of entering the Earth's atmosphere has shown that maximum entry speeds can be expected to range from about 15 to 18 km/sec. The problems of entry at these hyperbolic speeds are then compared with the problems of entering at Apollo's speed of about 11 km/sec. These comparisons include corridor depths, acceleration histories, and convective and radiative heating. It is also shown that for missions to Mars and Venus the entry speeds are relatively modest, being about 6 to 10 km/sec at Mars and about 11 to 13 km/sec at Venus. With the low surface pressures estimated for Mars, very large parachutes deployed at conditions well beyond current experience will be required. Author

N69-15655*# Techtran Corp., Glen Burnie, Md.
INTRODUCTION TO THE INTERNATIONAL SCIENTIFIC SATELLITE ESRO 2/IRIS
P Blassel et al 1968 14 p Transl. into ENGLISH from ESRO/ELDO Bull. (France), 2 Aug. 1968 p 6-9
(Contract NAS5-14826)
(NASA-CR-99125) Avail: CFSTI CSCL 22B

A nontechnical summary is presented of the scientific makeup, the structure, energy supply, altitude control, and data transmission of the ESRO 2/IRIS satellite. The design, scientific experiments, and control of this craft were international joint efforts. Solar astronomy and cosmic rays were the research fields forming the subject of the seven experiments placed on board; they constituted a scientific payload of 21.316 kg out of a total satellite weight of 74 kg. IRIS was launched 17 May 1968 at 0306 hours European time. B.P.

N69-15656*# Techtran Corp., Glen Burnie, Md.
THE LAUNCHING OF THE ESRO 2/IRIS SATELLITE AS SEEN FROM REDU
J. Le Peltier 1968 4 p Transl. into ENGLISH from ESRO/ELDO Bull. (France), 2 Aug. 1968 p 33
(Contract NAS5-14826)
(NASA-CR-99128) Avail: CFSTI CSCL 22

Hourly reactions are recorded for the successful launch of the ESRO 2/IRIS satellite on 17 May 1968 at 0206 hours Greenwich time for the personnel at the Redu installation. B.P.

N69-15657*# Techtran Corp., Glen Burnie, Md.
THE ESRO 2/IRIS SATELLITE LAUNCH AS SEEN FROM ESTEC
J. Toussaint 1968 7 p Transl. into ENGLISH from ESRO/ELDO Bull. (France), 2 Aug. 1968 p 34-35
(Contract NAS5-14826)
(NASA-CR-99124) Avail: CFSTI CSCL 22D

Reactions to the visual observation of the launch of ESRO 2/IRIS satellite on 17 May 1968 are reported. The success of the launching, orbiting, and communication with the satellite is followed step by step. B.P.

N69-15698*# Techtran Corp., Glen Burnie, Md.
THE LAUNCHING OF THE ESRO 2/IRIS SATELLITE, VANDENBERG AIR FORCE BASE (CALIFORNIA) ON 16 MAY 1968
P. Blassel 1968 10 p Transl. into ENGLISH from ESRO/ELDO Bull. (France), 2 Aug. 1968 p 25-28
(Contract NAS5-14826)
(NASA-CR-99129) Avail: CFSTI CSCL 22D

A narrative account of the launching of ESRO 2/IRIS satellite from Vandenberg Air Force Base on 16 May 1968 is presented. A.C.R.

N69-15784# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
EFFECT OF POWER DISSIPATION ON THE PLATFORM TEMPERATURES OF THE L.A.S.
R. Somoza Paris ESRO Dec. 1965 15 p refs
(ESRO-TM-P-126(ESTEC)) Avail: CFSTI

Eight new cases are studied for different values of the power dissipation in the platform and different thermal designs. The solutions are compared with the results of previous studies and the difficulties of evacuating the heat dissipated inside the platforms discussed. A line of action to be taken in an attempt to solve these difficulties is proposed, including the definition of a more detailed and realistic thermal model and some modifications in the design. Reference is also made to the work already carried out in this direction. ESRO

N69-15823 Nord-Aviation, Paris (France).
SATELLITE CONTROL BY BLASTS FROM MICROJETS [ECLATEMENT DE JETS DE MICROTUYERES POUR SATELLITES]
Bombled [1968] 35 p refs In FRENCH Presented at the 5th Colloq. d'Aerodynamique Appl., Poitiers, France, 6-8 Nov. 1968
Avail: CFSTI

Theoretical boundary layers of jet exhaust were verified experimentally. The tests, using microrocket nozzles discharging in a vacuum, showed the importance of the layers when they are used to modify the jet structure or jet exhaust spread. The nozzles are similar to those in the stabilization system of satellite D2 used to maintain its rotation axis pointed toward the sun. Four types of divergent nozzles were studied with 0°, 5°, 10°, and 15° angles of divergence at the outlet. The conclusions reached follow. The jet exhaust of the micronozzles with small dimensions or large Mach numbers is completely different from that predicted by theory; the theory is valid for micronozzles with large dimensions or low Mach number. The discrepancy is due to the presence of a thick boundary layer which brings about an increase of the exhaust blast by expanding the peripheral boundaries which are at weak Mach number. Transl. by B.P.

N69-15826# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
FIRST ESTIMATION OF WEIGHTS FOR THE L.A.S. AND SPECIFIC WEIGHTS OF SATELLITES
R. Somoza Paris ESRO Feb. 1967 6 p
(ESRO-TM-P-90(ESTEC)) Avail: CFSTI

This is a compilation of the weights for the Large Astronomical Satellite, based on a very preliminary estimation by the groups working in the different subsystems. The weights of the Guidance and Control System, Scientific Experiments and Structure have been estimated by the corresponding groups after consideration of their components, together with considerations on the probable dimensions and materials used or on published data for components. For comparison purposes, the volume of fifteen satellites, excluding solar peddles, has been evaluated approximately, and the specific weights, $\rho = v/w$, based on published total weights, calculated. A few averages have been included at the end. ESRO

N69-15830# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
LARGE ASTRONOMICAL SATELLITE SPACE REFERENCE SYSTEM
A. Bastos Paris ESRO Apr. 1966 28 p refs
(ESRO-TM-P-129(ESTEC)) Avail: CFSTI

A study is made of various possible solutions to the problem of the space reference system of the L.A.S. in relation to platform length, with comments limited to the space reference aspect only. Other aspects, such as weight, structure, control system, electronics, solar peddles, etc. have not been dealt with. ESRO

N69-15851# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
A POSSIBLE ATTITUDE CONTROL SYSTEM FOR THE L.A.S.
B. Sunesson Paris ESRO Dec. 1966 28 p
(ESRO-TM-P-87(ESTEC)) Avail: CFSTI

This paper, the contents of which are taken from a seminar given at the ESRO 1966 Summer School held in Helsingor, Denmark, discusses in general terms the Large Astronomical Satellite (LAS) control system based on continuous stellar reference. ESRO

N69-15852# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
LARGE ASTRONOMICAL SATELLITE FIRST ESTIMATION OF THERMAL DISTORTIONS IN A STABLE PLATFORM
R. Somoza Paris ESRO Apr. 1966 23 p
(ESRO-TM-P-128(ESTEC)) Avail: CFSTI

The thermal distortions of a simplified tubular platform are studied for combinations of two different lengths and two types of thermal coatings. For comparison purposes the use of eight light alloys for the platform is considered and the approximate gradients and angular distortions obtained for the four examples studied are listed. It is concluded that from the thermal, mechanical and weight points of view beryllium would seem to be the most suitable alloy, followed by aluminum and magnesium. ESRO

N69-15853# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
USE OF REACTION WHEEL TACHOMETER FEEDBACK IN THE COARSE ATTITUDE CONTROL LOOP OF THE L.A.S.
D. N. Soo Paris ESRO Jun. 1966 37 p refs
(ESRO-TM-P-141(ESTEC)) Avail: CFSTI

This study has been carried out in an attempt to improve the performance of the L.A.S. coarse attitude control loop by the use of reaction wheel tachometer feedback. Two methods of using tachometer feedback are discussed–one employing negative compared with the previous loops proposed for L.A.S. The study shows that use of positive feedback improves the response of the loop to large signal inputs and that the loop is easier to mechanize since no integrator in the compensation is needed. However to achieve the desired positive feedback may be difficult from the stability point of view. An analogue computer simulation was made to investigate the non-linear response of the loops. ESRO

N69-15891# European Space Technology Center, Noordwijk (Netherlands). Large Astronomical Div.
LARGE ASTRONOMICAL SATELLITE SOLAR PADDLE CONFIGURATIONS AND AVAILABLE POWER
R. Somoza Paris ESRO Sep. 1964 20 p
(ESRO-TM-P-5(ESTEC)) Avail: CFSTI

A choice having been made regarding the location of the proposed four solar paddles–i.e. attached to the structure around the gymbal for the stable platform–so as to obtain the projection of a significant area on the plane normal to the sun's rays and to minimize the problem of occultation of reference stars, nine possible shapes are discussed. The average projected areas as a function of the direction of the solar rays are measured and an estimate made of the average power generated for each solar paddle configuration. The advantages and disadvantages of the different shapes are compared and a recommendation made as to the most suitable type. ESRO

N69-15895# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
MEMORY CAPACITY AND STORAGE METHOD FOR THE L.A.S.
G. L. Reijns Paris ESRO May 1965 20 p
(ESRO-TM-P-101(ESTEC)) Avail: CFSTI

The required storage capacity for storing the data of the ultraviolet spectrum of a star is investigated. Redundancy is introduced by an overlapping of the scanning of the spectrum interval by adjacent photomultipliers. Two 'processing' methods are described to enable a reduction of the required storage capacity. It is recommended that both a magnetic core store and tape recorder be provided on board the satellite. Author (ESRO)

N69-15921# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
OUTLINE OF COMPUTER SIMULATION FOR THE CONTROL SYSTEM OF THE L.A.S.
D. N. Soo Paris ESRO Aug. 1968 24 p
(ESRO-TM-P-142(ESTEC)) Avail: CFSTI

The pertinent features for a computer simulation of the three axis attitude control system proposed for the Large Astronomical Satellite are discussed. A brief outline is given of a simulation program of studies to be carried out, together with details of Phase I Simulation (coarse and fine attitude control). Author (ESRO)

N69-16038# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
RESULTS ON A PRELIMINARY ANALOG COMPUTER SIMULATION OF THE COARSE CONTROL TRANSIENT RESPONSE OF THE L.A.S.
D. N. Soo Paris ESRO May 1965 34 p refs
(ESRO-TM-P-118(ESTEC)) Avail: CFSTI

This note discusses the results of the Large Astronomical Satellite coarse control loop having been simulated for single and three axis motion. The object of the simulation was to investigate the performance of the transient response of the satellite with special regard to: the effect of saturation non-linearity in the control loop, the effect of gyroscopic cross coupling due to three axis motion and the effect of initial wheel momentum loading. A simplified mathematical model of the slewing mode of the satellite was also simulated. The simulation results indicate no serious loss or degradation of stability due to the above effects. Further study of the system, and especially the slewing mode, is needed in order to assess fully the transient response performance of the satellite. Author (ESRO)

N69-16039# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
LARGE ASTRONOMICAL SATELLITE POWER SUPPLIES
J. G. Fielding Paris ESRO Jul. 1967 21 p refs
(ESRO-TM-P-119(ESTEC)) Avail: CFSTI

Estimates of the power requirements of the Large Astronomical Satellite are made, from which the battery parameters and the projected area of the solar paddles are deduced. Appendices are included setting out the merits of Ni-Cd and Ag-Cd batteries and on the effect of radiation environment on the solar cells. ESRO

N69-16045# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
LARGE ASTRONOMICAL SATELLITE PLATFORM ARRANGEMENT
R. Somoza Paris ESRO Dec. 1965 28 p refs
(ESRO-TM-P-123-ESTEC) Avail: CFSTI

A sketch of a possible platform arrangement is presented. An actual arrangement of the components, which is not feasible at this stage, has not been attempted but simply as realistic a solution as possible consistent with the present knowledge of components. Some attempt has been made to achieve a balance between the several conflicting requirements, taking into account the more critical requirement that of the necessity for maintaining the pointing accuracy inside very narrow tolerances. The main reasons for the choice of such a configuration are given. This arrangement can of course only be a first approximation and modifications will be necessary following more detailed calculations

and knowledge of the components. The external shape of the thermal shield is also presented. Some minor modifications to a previous sketch already discussed with the leaders of several Groups concerned in the L.S.D. have also been included in this new version. Brief calculations, of a very preliminary nature, have been made in order to obtain realistic dimensions and are presented in the Appendix. ESRO

N69-16051*# National Aeronautics and Space Administration, Washington, D. C.
SOLAR OBSERVATORY SET FOR LAUNCHING
20 Dec. 1968 21 p refs Press Kit
(NASA News Release-68-13) Avail: NASA Scientific and Technical Information Division CSCL 22B

Prelaunch briefing data are presented on the Orbiting Solar Observatory (OSO-5) which was designed to study the sun and its influence in the interplanetary space near the earth. The primary objective of the OSO-5 is to obtain high spectral resolution data (within the 1 Å to 1250 Å range) from the eight onboard solar experiments pointed toward the sun. A fact sheet lists the pertinent information about the Observatory, the launch phase, and the Observatory power subsystem. An overview is included on the accomplishments of the first four OSO experiments. Statistics on the Delta launch vehicle are also provided. M.G.J.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-15020 Texas Univ., Austin.
AXISYMMETRIC STRESS-WAVE PROPAGATION ACROSS THE PLANE INTERFACE BETWEEN TWO CYLINDRICALLY-BOUNDED MEDIA
Gerald Kirby Miller, II (Ph.D. Thesis) 1967 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-4319

Using scalar and vector displacement potentials and the vector equation of motion in the solid and the scalar displacement potential and scalar wave equation in the liquid, the displacement and stress fields are expressed as infinite sums over the eigenvalues found from dispersion relations resulting from the satisfaction of the appropriate wave equations and the transverse boundary conditions. To obtain numerical results these sums are truncated, and the interface boundary conditions are satisfied at enough points along a radius to allow solving for the amplitude coefficients in the truncated series. The fields are then constructed at any point using these coefficients in the appropriate truncated series and intensity, power, and transmission loss are obtained from the fields. Computer results for the case of nylon to water over a limited frequency range validate the approximation procedure and provide new information about the stress and displacement fields as functions of frequency, axial position and radial position. Dissert. Abstr.

N69-15052 Oklahoma State Univ., Stillwater.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF A MONOLITHIC TRAPEZOIDAL SHEAR PANEL SUBJECTED TO MECHANICAL LOADING
Everett Lamar Cook (Ph.D. Thesis) 1967 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-8382

The matrix displacement and matrix force methods of structural analysis are used to predict the strains and displacements of a monolithic trapezoidal shear panel under mechanical loading. The results of an experimental program are presented and used to verify the analytical results. It is concluded that the monolithic shear panel is a valuable tool for use in obtaining accurate experimental results which can be used to verify new methods of structural analysis. The validity of the trapezoidal plate stiffness matrix and the self-equilibrating force systems was demonstrated by the excellent agreement between analytical and experimental results. It is shown that the displacement and force analyses give the same results if identical mathematical models are used for these analyses. Dissert. Abstr.

N69-15080# Los Alamos Scientific Lab., N. Mex.
ON VARIOUS NONDESTRUCTIVE TESTING ACTIVITIES OF THE LOS ALAMOS SCIENTIFIC LABORATORY
Gerold H. Tenney, Neville B. Edenborough, H. J. Fullbright, and T. G. Gregory [1968] 12 p refs Presented at the Conf. on Nondestructive Testing and Control in the Field of Nucl. Metallurgy and Technol., Saclay, France, 24–26 Jun. 1968.
(Contract W-7405-ENG-36)
(LA-DC-9429; CONF-680806-2) Avail: CFSTI

Some highlights of recent work in the field of nondestructive testing (NDT) are described: (1) eddy-current detection of cracking during thermal transient, (2) on-line data processing, and (3) replica inspection of narrow bore surfaces in tubes. The roles of NDT and a NDT engineer in industry are discussed. NSA

N69-15096 Oklahoma State Univ., Stillwater.
THE EFFECT OF MECHANICAL VIBRATION ON THE NEGATIVE PRESSURE OF PURE LIQUIDS
George Patrick Mulholland (Ph.D. Thesis) 1967 147 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 68-8468

A general analytical procedure for describing the pressure distribution and the velocity distribution inside a fluid-filled cylindrical tube was developed and the pressure distribution was verified experimentally. The equations for pressure and velocity were programmed for analysis by an IBM 1620 digital computer. The programs are immediately applicable to systems having small values of amplitude and frequency and can easily be extended to include systems with large values for amplitude and frequency. To verify the solution, the wall pressure distribution was obtained for a liquid-filled vibrating cylindrical tube for comparison with the numerical results. The comparison verified the analytical solution. The numerical values for the velocities were assumed to be correct since the numerical results for the pressures agreed so well with the experimental values. Dissert. Abstr.

N69-15108 Oklahoma State Univ., Stillwater.
AN INVESTIGATION OF UNSTIFFENED AND STIFFENED RECTANGULAR CANTILEVERED PANELS USING ENERGY METHODS
John Melvin Levosky (Ph.D. Thesis) 1967 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-8445

A stress function was developed for a cantilevered unstiffened panel by means of the Method of Timoshenko. The stress function was used to evaluate the stresses in the panel. The stresses for the unstiffened panel were extended by similarity techniques to determine the stresses in a cantilevered stiffened panel. Deflection equations were developed for a cantilevered unstiffened panel by means of the Rayleigh-Ritz Method. The deflections for the unstiffened panel were extended by similarity techniques to determine the deflections of a cantilevered stiffened panel. The stresses in the unstiffened panel compared within 3% of those obtained from an analysis by Timoshenko. The σx stresses in the stiffened panel obtained by the Method of Timoshenko compared within 5% of those obtained from a stiffness analysis but differed by 18% from experimental values. The τxy stresses compared within 5% of

those obtained from a stiffness analysis but differed by as much as 43% from experimental values. Dissert. Abstr.

N69-15118 Minnesota Univ., Minneapolis.
MULTI-PARAMETER OPTIMUM DAMPING IN LINEAR DYNAMICAL SYSTEMS
John Carter Mc Munn (Ph.D. Thesis) 1967 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-7359

The proper amounts and distribution of damping are important parameters for the control of the resonant response of n degree-of-freedom and continuous dynamical systems. In many cases it is actually possible to increase the resonant response by overdamping the system. Under these circumstances there is a certain combination of damping parameters in a discrete system or a certain distribution of damping in a continuous system that minimizes the maximum of all of the resonant responses in any given frequency interval. This damping is known as the optimum damping. This dissertation rigorously formulates the multi-parameter optimum damping problem for harmonically excited, linear, stable, strictly dissipative n degree-of-freedom systems and defines optimum damping as the damping required to minimize an appropriately defined objective function. Dissert. Abstr.

N69-15120 University of Southern California, Los Angeles.
A STUDY OF THE STABILITY OF CYLINDRICAL SHELLS SUBJECTED TO AXIAL IMPACT
Leslie Martin Lackman (Ph.D. Thesis) 1967 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-5868

A study was conducted to determine the stability of cylindrical shells which were subjected to axisymmetric impact loads. Both perfect and imperfect shells were considered. The stability of perfect shells was studied by subjecting the prebuckled symmetric displacements to asymmetric perturbations, and studying the behavior of the perturbed system with time. The prebuckled state was considered to be stable if the displacements in the perturbed state remain bounded in time. The behavior of the perfect shell in the perturbed state was determined by numerically integrating the equations of asymmetric motion. Similarly, for buckling of imperfect shells, which is a response problem, the aforementioned asymmetric equations of motion were numerically integrated, and the influence of load intensity and magnitude and shape of imperfections on the response of the shell was determined. Both linear and nonlinear responses were studied. Dissert. Abstr.

N69-15127 New York Univ., N. Y.
EIGENFUNCTION EXPANSIONS ASSOCIATED WITH THE LAPLACIAN FOR CERTAIN DOMAINS WITH INFINITE BOUNDARIES
Charles Irwin Goldstein (Ph.D. Thesis) 1967 75 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-6066

An expansion theorem is proven for the negative Laplacian acting on functions with zero boundary conditions in a perturbed semi-infinite cylinder in N-dimensional Euclidean space. The case of an unperturbed cylinder is discussed first. The spectral multiplicity is completely determined and a complete, orthogonal set of generalized eigenfunctions is explicitly given. The finite end of the cylinder is then subjected to certain perturbations. Two sets of generalized eigenfunctions are constructed for the perturbed cylinder. They are constructed using the method of limiting absorption. The behavior of these eigenfunctions at infinity is described by means of a radiation condition analogous to the Sommerfeld radiation condition for the exterior problem. These functions are shown to form a complete, orthogonal set of generalized eigenfunctions for certain types of perturbed cylinders. Dissert. Abstr.

N69-15140 Columbia Univ., New York.
VIBRATIONS OF FLUID-FILLED SPHERICAL AND SPHEROIDAL SHELLS
Richard Herbert Rand (Ph.D. Thesis) 1967 42 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-5623

Frequency equations and mode shapes are obtained in analytic form for the axisymmetric, extensional, nontorsional vibrations of fluid-filled elastic spherical shells and rigid prolate spheroidal shells, while a numerical scheme is developed for the fluid-filled elastic prolate spheroidal shell. Extensive numerical results in the form of frequency spectra and mode shapes for these problems are displayed. Dissert. Abstr.

N69-15161 Oklahoma State Univ., Stillwater.
RESPONSE SPECTRA OF COUPLED ACOUSTICAL RESONATORS TO TRANSIENT EXCITATION
Narayana N. Reddy (Ph.D. Thesis) 1967 126 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-8484

The response of a double acoustical resonator to transient excitations was investigated to ascertain the influence of various system parameters and types of excitation on the pressure magnification in the cavities. The mathematical model was generated by assuming lumped parameters. Response equations were derived as a function of uncoupled frequencies and damping factors. Criteria for the maximax response of a two degree-of-freedom system subjected to finite duration transient excitations were determined as a function of coupled and uncoupled natural frequencies, damping factors, and the period of external pressures. Pressure magnification in the cavities can vary from small values to as large as about 15, depending on the system parameters. For excitation pressures of sine pulse type, the critical condition occurs when the two uncoupled natural periods, two coupled natural periods, and the period of excitation pressure are equal. Dissert. Abstr.

N69-15257# Battelle-Northwest, Richland, Wash. Pacific Northwest Lab.
RECENT NONDESTRUCTIVE TESTING ADVANCES AT BATTELLE-NORTHWEST LABORATORY, PART 1
D. C. Worlton 1 May 1968 8 p refs Presented at the Symp. on Nondestructive Testing and Control in the Field of Nucl. Met. and Technol., Saclay, France, 24–26 Jun. 1968
(Contract AT(45-1)-1830)
(BNWL-SA-1772-PT-1; CONF-680606-1) Avail: CFSTI

Acoustic emissions internally released in materials undergoing deformation or fracture may provide early warning of incipient failure of critical nuclear components, such as reactor pressure vessels or piping, during routine operations. A practical monitoring system based on this principle requires detection of acoustic emission signals against normal background noises, location of emission point of origin, characterization of failure or flaw growth mechanisms, and prediction of time of failure. Experimental data using this method to study crack propagation in large diameter steel pipe are presented. Further development work on the monitoring equipment and study of the relationship between emission signal characteristics and the irreversible metallurgical events which give rise to these signals is recommended. NSA

N69-15317# SAAB Aircraft Co., Linkoping (Sweden).
THEORETICAL ANALYSIS OF SYMMETRICALLY LOADED CIRCULAR CYLINDRICAL SHELLS WITH VARIOUS ENDCONFIGURATIONS
Lars A. H. Johansson Aug. 1968 83 p refs
(SAAB-TN-66) Avail: CFSTI

An accurate method is described for computer calculation of strains and stresses in complicated shells of revolution. The manual work needed for the calculation consists in subdividing the structure into suitable segments and writing the geometrical values

and loadings for the various segments into a parameter list in accordance with a given instruction. As a result the linear and angular deformations and the stresses at the junctions between the different segments are obtained. The theory for the development of this calculation routine and a few examples of practical applications are given and a comparison is made with experimental results. Author

N69-15339 State Univ. of Iowa, Iowa City.
THE INFLATION OF AXIALLY SYMMETRIC MEMBRANES BY LINEARLY VARYING HYDROSTATIC PRESSURE
Lawrence Kuang Yu (Ph.D. Thesis) 1967 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-5997

The theory of large deformation of elastic membranes is applied to the problem of the inflation of an axially symmetric membrane by a linearly varying hydrostatic pressure. The membrane considered is made of neo-Hookean material. Under the assumption of very large deformation, it is shown that the stress resultants on the middle surface of the membrane are everywhere equal and constant. The problem is then reduced to a purely kinematic one. The governing equation is found to be a non-linear integral equation of Volterra type. Further study of the problem shows that, irrespective of their initial configurations, axially symmetric membranes tend to deform to an identical shape under the present system of deforming forces. The exact analytical solution of the non-linear integral equation has not been found. A computer program has therefore been developed to generate a numerical solution describing the deformed shape when the pressure is exerted by various types of fluids with different weight densities. Dissert. Abstr.

N69-15357*# Lehigh Univ., Bethlehem, Pa. Inst. of Research.
FATIGUE CRACK PROPAGATION IN CYLINDRICAL SHELLS UNDER TORSION
Fred J. Fisch and Fazil Erdogan Oct. 1968 60 p refs
(Grant NGR-39-007-011)
(NASA-CR-99086) Avail: CFSTI CSCL 20K

An experimental investigation was conducted to determine fatigue crack growth rates for inclined cracks in thin cylindrical shells of 6063-T6 aluminum under reversed cyclic torsion. For the analysis and the correlation of the fatigue results, the stress intensity factor was used. The fatigue crack propagation in 6063-T6 aluminum for this fully reversed tension-compression biaxial loading is compared with the known results for 6063-T6, 7075-T6 and 2024-T3 aluminum alloys. One of the tentative conclusions reached was that the crack propagation rate is influenced by the bi-axial nature of the loading away from the crack. The crack growth rate increases if the stress component parallel to and away from the crack is tension, and decreases if it is compression. Author

N69-15376#
WAVE PROPAGATION IN A POROUS MEDIUM
G. A. Van Fo Fy [1968] 5 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR (Kiev), ser. A, no. 9, 1968 p 845-849
Avail: CFSTI

A method is proposed for investigating elastic wave propagation in a perforated medium, taking into account deformation phenomena. A solution is constructed for the case of longitudinal wave propagation. Author

N69-15378*# Brown Engineering Co., Inc., Huntsville, Ala.
THE GENERAL INSTABILITY OF ECCENTRICALLY STIFFENED CYLINDRICAL SHELLS UNDER AXIAL COMPRESSION AND LATERAL PRESSURE
John N. Dickson and Richard H. Brolliar Washington NASA Jan. 1969 120 p refs
(Contract NAS8-20073)
(NASA-CR-1280) Avail: CFSTI CSCL 20K

A method of determining the general instability load of an orthogonally stiffened cylindrical shell under axial compression and lateral pressure is presented. The governing equations were derived using small deflection theory; and, consequently, the validity of the method must be restricted to moderately or heavily stiffened cylinders. All the stiffnesses occurring in stiffened shells of this type were incorporated, and the rings and stringers were considered eccentric with respect to the skin middle surface. Local buckling of the skin between adjacent stringers before general instability was allowed, and the resulting reductions in stiffness properties of the skin were determined as a function of the two principal strains. Analytical and experimental results are compared for twenty-nine stiffened cylinders loaded in compression and for six stiffened cylinders loaded in bending. The method has been programmed for use with an IBM 7094 computer. The computer program and detailed instructions for its use are included. Author

N69-15444 Illinois Univ., Urbana.
ANALYSIS OF SHELLS BY A NON-ORTHOGONAL DISCRETE ELEMENT SYSTEM
Jose Antonio Pedilla (Ph.D. Thesis) 1967 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-8190

In this study, a discrete model is developed for the analysis of shells of arbitrary shape. The model consists of rigid cross bars connected to each other by deformable nodes. The bars can be directed along any system of coordinate lines upon the surface. The nodes have extensional and shear properties similar to those of the material out of which the real shell is made. Tangential displacements are specified at the intersections of the rigid bars. The normal displacement is defined at the deformable nodes. External loads are applied at the points where the corresponding displacements are defined. The strain-displacement of relations are derived from the model by considerations of the geometry involved in the deformation of the shell. The equilibrium equations, in terms of the three displacements, are formulated by the principle of virtual displacement. A computer program is developed which generates the equilibrium equations. Dissert. Abstr.

N69-15457# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).
FORTRAN 4 PROGRAMS FOR COMPUTATION OF TEMPERATURE AND THERMOELASTIC STRESS IN A HOMOGENEOUS SPHERICAL FUEL ELEMENT DUE TO ARBITRARY HEAT TRANSFER VARIATION OVER THE SURFACE
Z. J. Holy (New South Wales Univ.) Jul. 1968 30 p refs
(AAEC/TM-470) Avail: CFSTI

Computer programs together with a brief outline of the theory are presented, which enable computation of temperature and thermoelastic stress fields in homogeneous spherical fuel elements due to arbitrary heat transfer variation over the surface. Uniform heat generation in the fuel element is assumed. Author (NSA)

N69-15479# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
COMET CODE: COMPUTATION OF THE MECHANICAL AND THERMAL STRESSES IN FUEL ELEMENT CANS [CODICE COMET. CALCOLO DELLE TENSIONI MECCANICHE E TERMICHE NELLE GUAINE DI UN ELEMENTO COMBUSTIBILE]
M. Fantozzi 13 May 1968 30 p refs In ITALIAN
(EUR-4049) Avail: CFSTI

By the COMET code, a method has been established to calculate mechanical and thermal stresses in a cross section of fuel element claddings in a vertical pressure tube reactor, taking into account circumferential and radial temperature distributions. Axial stresses are evaluated by different schemes, according to the fuel element structure and the coolant circulation direction. Author (NSA)

N69-15480*# California Inst. of Tech., Pasadena. Firestone Flight Sciences Lab.
FAILURE CRITERIA FOR VISCOELASTIC MATERIALS Quarterly Progress Report
W. G. Knauss Dec. 1968 7 p
(Grant NGL-05-002-005; Proj. GALCIT-120)
(NASA-CR-99085; GALCIT-SM-68-19) Avail: CFSTI CSCL 20K

Results of crack propagation in linearly viscoelastic materials were analyzed. An apparent discrepancy in results was found by allowing the crack to propagate in infinitesimal jumps, on one hand, and allowing it to grow continuously, on the other. To solve this problem a reasonable assumption was made concerning the stress history to which the material was subjected, and this resulted in variations in the final differential equation describing the motion of the crack. It was concluded that although differences in theoretical formulation of the crack propagation problem arise, their practical consequences are apparently not important. Work was also extended to derive more general loading histories, specifically cyclic loading and its relation to fatigue. The integro-differential equation was solved for the case of very long time fracture. An attempt was made to experimentally verify a fundamental assumption in solid rocket technology, namely that of thermorheological simplicity under transient temperature variations. B.P.

N69-15632*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE INFLUENTIAL ASPECTS OF ATMOSPHERIC DISTURBANCES ON SPACE VEHICLE DESIGN USING STATISTICAL APPROACHES FOR ANALYSIS
Robert S. Ryan and Alberta W. King Washington Jan. 1969 112 p refs
(NASA-TN-D-4963) Avail: CFSTI CSCL 22B

The influential aspects of various wind profile disturbances on the dynamic response of the vehicle are considered. Particular emphasis is given to separating the influence of wind shears, turbulence and quasi-steady wind speed on the dynamic response during the boost phase of flight. Four hundred and seven individual detailed (Jimsphere) wind profiles are the primary wind inputs, although the MSFC synthetic profile is also discussed. The time response to each profile is run and a statistical analysis made. Severe profiles are ranked in terms of the bending moment at two vehicle stations for the Saturn 5 vehicle. The influence of results on vehicle design and flight operational procedures is determined. Author

N69-15738# Los Alamos Scientific Lab., N. Mex. Group GMX-1.
HIGH TEMPERATURE EDDY-CURRENT CRACK DETECTION
N. B. Edenborough [1968] 12 p Presented at 28th Natl. Fall Conf. of the Am. Soc. for Nondestructive Testing, Detroit, 14–17 Oct. 1968
(Contract W-7405-eng-36)
(LA-DC-9382; CONF-681004-2) Avail: CFSTI

A technique was developed to detect the time of cracking of samples representing atomic reactor components under high thermal gradients. An eddy current coil of tungsten-rhenium wire (W-26%Re) was wound on a specially machined boron nitride coil form. This coil operates at temperatures up to approximately 3200°F. This temperature was reached, from ambient, in 22 seconds. Special electronic circuitry was also developed to detect the small signal change caused by the cracking but ignoring the large changes caused by the quick heating. Author (NSA)

N69-15740# Atomic Weapons Research Establishment, Aldermaston (England).
SIZE ANALYSIS OF WHISKERS: A SURVEY OF POSSIBLE METHODS
R. E. Cooper Sep. 1968 19 p refs
(AWRE-O-71/68) Avail: CFSTI/HMSO: 4s

The importance of the diameter and length of reinforcing fibers in a composite material are explained and possible methods for determining these properties are considered. These methods include sedimentation, quantitative microscopy, optical Fourier analysis and the Coulter counter. It is concluded that quantitative microscopy using the Quantimet image analyzing computer offers the greatest promise. Author (NSA)

N69-15744*# Arde, Inc., Paramus, N. J.
RESEARCH AND DEVELOPMENT ON CRYOGENIC STRETCH-FORMED HELIUM BOTTLES SATURN 4-B Final Report
R. Alper Dec. 1968 198 p refs
(Contract NAS8-20713)
(NASA-CR-61251) Avail: CFSTI CSCL 20K

A program was conducted to establish the manufacturing technology required to produce 22 in. diameter spherical helium pressure vessels for service at −423F. The vessels incorporated several attachment bosses and a fill port and were manufactured by means of a cryogenic stretch forming process. A low silicon chromium nickel stainless steel alloy was used. Six vessels of the desired configuration were produced for delivery. In addition, mechanical property tests were performed with several heats of this alloy. Author

N69-15771# Mound Lab., Miamisburg, Ohio.
THE EFFECT OF EXPERIMENTAL VARIABLES ON CRUSH STRENGTH DETERMINATIONS
W. H. Smith 16 Sep. 1968 21 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1540) Avail: CFSTI

Possible effects of variables on the determination of the crush strength of $^{238}PuO_2$ microspheres were evaluated. Test results indicated that crush strength increases with particle size. It was unaffected by age in a test of microspheres up to 17 months old. Changes made in the production process have not affected the crush strengths of microspheres. Crush strength apparatus with a photoelectric detection system and with a force-transducer detection system yielded data which agreed within experimental error. Crush strength can be used for production quality control if the particle size-crush strength relationship is known. Author (NSA)

N69-15788# Stanford Univ., Calif. Dept. of Applied Mechanics.
ON THE INITIAL SLOPE OF ELASTIC-PLASTIC BOUNDARIES IN COMBINED LONGITUDINAL AND TORSIONAL WAVE PROPAGATION Interim Technical Report
T. C. T. Ting Sep. 1968 43 p refs
(Contract DA-04-200-AMC-659(X))
(AD-678482; BRL-CR-14; TR-188) Avail: CFSTI CSCL 20/11

The elastic-plastic boundaries which start at the end of a tube in wave propagation of combined longitudinal and torsional stresses are studied. The longitudinal and torsional stresses applied at the end of the tube are assumed to be continuous and the initial slope of the boundaries are determined analytically for all possible combinations of the time derivatives of stresses before and after the elastic-plastic boundaries occur. It is seen that a continuous loading into a higher yield surface at the end of the tube does not necessarily produce a continuous plastic region near the end of the tube. Also, more than one elastic and plastic region can be generated near the end of the tube even though the stresses at the end of the tube are continuously increasing to a higher yield surface. These and other unexpected results are presented in this paper. Author (TAB)

N69-15882# California Univ., La Jolla. Dept. of the Aerospace and Mechanical Engineering Sciences.
ON CERTAIN CLOSED-FORM SOLUTIONS TO PROBLEMS OF WAVE PROPAGATION IN A STRAIN-HARDENING ROD
R. C. Shieh Aug. 1968 30 p refs
(Contract DASA01-68-C-0017)

(AD-678388; DASA-2134) Avail: CFSTI CSCL 20/11

One-dimensional wave propagation in a semi-infinite strain-hardening rod loaded at one end by a suddenly applied and thereafter monotonically decreasing compressive stress is considered. The general problem is discussed and expressions for stress, strain and velocity, together with the governing differential equations for a strain-hardening shock wave are given in their general forms. Closed-form solutions are obtained for stress-strain relations consisting of a power law for loading beyond an initial elastic range and a constant strain law for unloading in the entire range of strain. Author (TAB)

N69-15901*# Techtran Corp., Glen Burnie, Md.
INVESTIGATION OF FRAGMENTS FROM SPACE VEHICLES [UNDERSOKNING AV FRAGMENT FRAN RYMDFARKOSTER FORSVARETS FORSKNINGSANSTALT, AVDELNING, SUNDBYBERG]
Gilbert Larsson Washington NASA Jan. 1969 43 p ref Transl. into ENGLISH from Swedish Report FOA-1-A-1433-40(12)
(Contract NASw-1695)
(NASA-TT-F-12083; FAO-1-A-1433-40(12)) Avail: CFSTI CSCL 20K

An account is presented of an investigation of two found objects of foreign origin. The purpose was to determine their nature, origin and use, and to try to develop a certain routine for investigations of this kind. The result of the investigation shows that one object has been identified with a high degree of probability as a component of space vehicle 1965-26A. The second object might be derived from one of six indicated space vehicles from 1964. In both cases the origin is American. Author

N69-15926# Stanford Univ., Calif. Dept. of Applied Mechanics.
ELASTIC-PLASTIC WAVES FOR COMBINED STRESSES
Ning Nan Jul. 1968 91 p refs
(Contract DA-04-200-AMC-659(X))
(AD-678480; TR-184; Rept-11) Avail: CFSTI CSCL 20/11

The general case of plane wave propagation for combined stresses is considered in a half-space. The analysis is based on an elastic-plastic theory for an isotropic work-hardening material which satisfies a flow or incremental type law. The stress-strain curve is assumed concave towards the strain axis with possibly a bend at yield. The wave propagation analysis determines the motion to be governed by a system of quasi-linear hyperbolic equations of the first order. Two different types of loading are considered in this study--the coupled double shear loading and the combined pressure and shear. The loading functions are continuous and are assumed to be uniformly distributed over the surface for all t. Two distinct wave speeds are found in the plastic region for both loading types. For general loading plastic flow can propagate with each wave speed which may be as fast as the elastic wave speed. This is contrary to wave for a single stress component. This fact may have an important bearing on the interpretation of experiment, for which, in the past, propagation of plastic waves at elastic wave speed has been considered to indicate rate effects. Solutions of the problems are obtained by numerical integration along the characteristics on a step by step basis. The loading-unloading boundaries are determined in the x - t plane. For a simple case of the double shear problem when the components are in proportion, very good agreement is obtained between the numerical result and the known analytical solution. Author (TAB)

N69-15939# California Univ., San Diego. Dept. of the Aerospace and Mechanical Engineering Sciences.
PLASTIC YIELD AND REVERSE YIELD WAVES GENERATED BY IMPULSIVE ELECTROMAGNETIC RADIATION
L. W. Morland Oct. 1968 27 p refs
(Contract N00014-67-A-0109)
(AD-678381; TR-24) Avail: CFSTI CSCL 20/14

Absorption of radiation through a thin layer adjacent to an irradiated, stress free, surface causes rapid heating and the generation of stress waves. Temperature rises sufficient to cause plastic yielding in the initial stress jump and reverse yielding during the subsequent wave propagation are considered under the assumption of uni-axial strain. An elastic-plastic wave solution is constructed and compared with the purely elastic solution. In particular the reduced compressive and tensile stresses in the outgoing wave, and the pulse spread, are illustrated. Author (TAB)

N69-15940# Stanford Univ., Calif. Dept. of Applied Mechanics.
ELASTIC-PLASTIC DEFORMATION AT FINITE STRAINS
E. H. Lee Jun. 1968 27 p refs
(Contract DA-04-200-AMC-659(X))
(AD-678483; TR-183; Rept-10) Avail: CFSTI CSCL 20/11

In some circumstances, elastic-plastic deformation occurs in which both components of strain are finite. Such situations fall outside the scope of classical plasticity theory which assumes either infinitesimal strains or plastic-rigid theory for large strains. The present theory modifies the kinematics to include finite elastic and plastic strain components. For situations requiring this generalization, dilatational influences are usually significant including thermo-mechanical coupling. This is introduced through the consideration of two coupled thermodynamic systems: one comprising thermo-elasticity at finite strain and the other the irreversible process of dissipation and absorption of plastic work. The present paper generalizes a previous theory to permit arbitrary deformation histories. Author (TAB)

N69-15950# Stanford Univ., Calif. Dept. of Applied Mechanics.
PLANE WAVES DUE TO COMBINED COMPRESSIVE AND STRESSES IN A HALF-SPACE
T. C. T. Ting and Ning Nan Sep. 1968 34 p refs
(Contract DA-04-200-AMC-659(X))
(AD-678481; TR-185; Rept-12) Avail: CFSTI CSCL 20/11

The plane wave propagation in a half-space due to a uniformly distributed step load of pressure and shear on the surface was first studied by Blaich and Nelson. The material in the half-space was assumed to be elastic-ideally plastic. In this paper, we study the same problem for a general elastic-plastic material. The half-space can be initially prestressed. The results can be extended to the case in which the loads on the surface are not necessarily step loads, but with a restricted relation between the pressure and the shear stresses. Author (TAB)

N69-15970# Stanford Univ., Calif. Dept. of Applied Mechanics.
ON THE INITIAL SLOPE OF ELASTIC-PLASTIC BOUNDARIES IN LONGITUDINAL WAVE PROPAGATION IN A ROD
T. C. T. Ting Sep. 1968 25 p refs
(Contract DA-04-200-AMC-659(X))
(AD-678484; TR-187; Rept-13) Avail: CFSTI CSCL 20/11

In one dimensional wave propagation such as longitudinal waves in a rod, an elastic-plastic boundary may start at the end $x = 0$ of the rod depending on the stresses prescribed at $x = 0$. The initial slope of the elastic-plastic boundary at $x = 0$ can be determined easily if the time derivative $\dot{\sigma}_0$ of the stress σ on both sides of the elastic-plastic boundary are not zero. In this paper, the initial slope of the elastic-plastic boundary (or boundaries) is determined analytically when at $x = 0$ is continuous and vanishes at time $t = t_0$ while the second derivative $\ddot{\sigma}_0$ at t_0 may or may not be continuous. It is seen that an elastic region can be generated near the end of the rod even though the stress state at the end is continuously plastic. Author (TAB)

N69-15973# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
TESTS OF TYPE B RADIOACTIVE MATERIAL PACKING. THEORETICAL STUDY OF DEFORMATION OF A

CYLINDRICAL CONTAINER AFTER A FALL [EPREUVES DES EMBALLAGES DES MATIERES RADIOACTIVES DU TYPE B. ETUDE THEORIQUE DE LA DEFORMATION D'UN CONTENEUR CYLINDRIQUE APRES UNE CHUTE]

Jean-Claude Cally, Philippe Formery, and Michel Labrousse Mar. 1968 46 p In FRENCH

(CEA-R-3372) Avail: Issuing Activity

The packings used for transporting highly radioactive materials, e.g., irradiated fuels are usually made of two steel shells with lead in the space between. These packings are subjected to fairly strict safety regulations. In particular, they have to withstand a fall of 9 m without any of their contents being dispersed and without the radioactive protection being seriously affected. The study was an attempt to define the factors for representing the deformation, and to determine the impact shock damage resulting from a fall. Author (NSA)

N69-16074# Road Research Lab., Crowthorne (England).

CALCULATIONS OF STRESSES AND DISPLACEMENTS IN A LAYERED ELASTIC STRUCTURE

E. N. Thrower 1968 27 p refs

(RRL-LR-160; PB-179705) Avail: CFSTI CSCL 13B

The report gives an analysis of stress, strain and displacement in a general n-layered ideally-elastic structure (viewed as an idealisation of a road), subjected to an axially-symmetric stationary surface loading. The analysis leads to an efficient method of computing results, in which the work increases only proportionately to the number of layers. A computer programme based on the analysis is described briefly. Author (USGRDR)

N69-16081# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EXPANSION OF PLANE ONE-DIMENSIONAL WAVES UNDER SHOCK IN A PLASTIC MEDIUM

E. I. Andriankin 2 Feb. 1968 11 p refs Transl. into ENGLISH from Tr. Fiz. Tekhn. Inst. (Moscow), no. 5, 1960 p 55-61

(AD-678439; FTD-HT-23-1447-67) Avail: CFSTI CSCL 20/4

The report investigates the expansion of a shock wave in a medium which allows a variable condensation at the front of the wave. It is assumed that the shock wave arises under the influence of an instantaneously applied pressure which falls according to a set law. The speed of sound in the condensation medium is taken as constant or infinite. Author (TAB)

N69-16091# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EFFECTS OF STRUCTURAL DAMPING ON FLUTTER OF STRESSED PANELS

Charles P. Shore (M.S. Thesis—Va. Polytech. Inst.) Washington Jan. 1969 35 p refs

(NASA-TN-D-4990) Avail: CFSTI CSCL 20K

The flutter of stressed orthotropic panels with edge rotational restraint is investigated theoretically. A modal solution which utilizes two-dimensional quasi-steady aerodynamic theory and includes both structural and aerodynamic damping is presented. The investigation was conducted in an attempt to explain the existing discrepancies between theoretical and experimental results for stressed panels, in particular for panels stressed near buckling, the most critical flutter condition. Structural damping is represented in the present analysis in a manner consistent with the representation for a Kelvin-Voigt viscoelastic body. Numerical results are presented to indicate that such a representation of structural damping eliminates the physically untenable results that have been obtained for certain values of the input parameters in previous analyses. Additionally, representation of structural damping in this manner results in a reasonable correlation between theory and experiment over the entire range of stress from zero to buckling. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-15034# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

NINE-ROD CRITICAL HEAT FLUX INVESTIGATION, STEAM-WATER AT 600 TO 1400 psia Final Summary Report

E. Janssen Apr. 1968 58 p refs

(Contract AT(04-3)-189)

(GEAP-5616) Avail: CFSTI

Critical heat flux (CHF) data were obtained in two "clean" nine-rod test channels. The heat flux was uniform in the axial direction. Data were obtained both with all rods uniformly heated and with one of the corner rods slightly (on the order of 10%) higher than the average. The flow was varied from 0.3×10^6 to 1.25×10^6 lb/h-ft^2, and the pressure was varied from 600 to 1400 psia. Results indicate that: for rods in a normally-spaced square array, the CHF occurs on one of the corner rods; the CHF decreases as the average quality increases, other things being the same; there is no strong or consistent effect of length on CHF; there is no flow effect on CHF for flows greater than 0.75×10^6 lb/h-ft^2. In the range of pressures from 600 to 1400 psia, the CHF varies in an inverse manner with the pressure, other things being the same; and a reduction in rod-to-wall clearance from 0.135 inch to 0.060 inch causes a 15% reduction on CHF. Author (NSA)

N69-15036# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

MEASUREMENT OF HEAT TRANSFER AND GAS FLOW RESISTANCE IN SQUARE SAMPLES OF PACKED BEDS

P. C. Manins and E. Szomanski Jul. 1968 29 p refs

(AAEC/TM-465) Avail: CFSTI

Experimental measurements of the average surface heat transfer coefficient in a randomly packed bed are reported. Rectangular sample beds with square cross section were cut from a large bed of zirconite sand balls frozen in wax. The wax was removed after their installation in special sample holders. The cyclic temperature variation measuring technique was used in conjunction with a high pressure carbon dioxide loop to permit measurements at high Reynolds numbers of interest. The heat transfer data obtained are consistent with those in the literature. Pressure drop measurements were also made and the flow resistance values for the samples appear to be low compared with the data for full sized beds. Author (NSA)

N69-15037# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

A LITERATURE SURVEY OF VERTICAL FORCED FLOW HEAT TRANSFER TO HIGH PRESSURE WATER BELOW AND BEYOND THE CRITICAL HEAT FLUX

R. E. Helms Jul. 1968 14 p refs

(AAEC/TM-468) Avail: CFSTI

A survey is given of the literature dealing with two-phase flow heat transfer. A summary of information on heat transfer in the various flow regimes is presented and the more widely accepted heat transfer correlation equations covering these regimes are given. Emphasis is placed on information relevant to geometries used in the coolant channels of water-cooled reactors. A bibliography of the source material comprising some 85 papers is included. The survey is intended in part as a useful guide for those new to the subject. Author (NSA)

N69-15053 West Virginia Univ., Morgantown.
THERMAL CHARACTERISTICS OF SPECULAR-DIFFUSE TEMPERATURE CONTROL SYSTEMS IN A SOLAR SPACE ENVIRONMENT
David Lee Buskirk (Ph.D. Thesis) 1967 147 p
Avail: Univ. Microfilms; HC $7.00/Microfilm $3.00 Order No. 68-8337

A complex digital computer logic system is developed which enables the complete thermal analysis of a general specular-diffuse louver system. It is then possible to analyze an external louver system in a solar environment, an internal louver system in a solar environment and both internal and external louver systems exposed to extraneous diffuse energy sources such as solar panels. The results led to a complete reassessment of louver systems for spacecraft thermal control. A so-called "trapping effect," along with louver blade equilibrium temperatures which are effected dramatically by solar impingement angle, is uncovered, showing that previous analyses using the diffuse reflectance assumption lead to very large errors. It is concluded that the linear control system now used to adjust louver blade position is unacceptable for external louvers in a solar environment. A logical control system is needed which adjusts louver blade angle as a function of both louver blade angle and solar position. Dissert. Abstr.

N69-15060 Minnesota Univ., Minneapolis.
A THEORETICAL STUDY ON COMBUSTION AND EXTINGUISHMENT OF SOLID PROPELLANT ROCKET MOTORS DURING RAPID DEPRESSURIZATION
Tsuyoshi Hiroki (Ph.D. Thesis) 1967 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-7328

A method to compute the transient burning rates of solid propellant rocket motors was proposed. The conservation equations in the solid and gas phases were coupled with the chamber overall mass balance equation. The burning rate was determined as a connecting coefficient of these governing equations with the boundary conditions imposed at the propellant surface. It was assumed that the depressurizations were achieved by a sudden enlargement of the exhaust nozzle area. The results of the computations indicate that the burning rates during depressurizations are smaller than the steady state values at the corresponding chamber pressures. It was found that an extinguishment occurs when the depressurization parameter exceeds some critical value. Dissert. Abstr.

N69-15107 Michigan Univ., Ann Arbor.
A THEORETICAL STUDY OF FLAME EXTINCTION BY A COLD WALL AND FLAME IGNITION BY A HOT SURFACE
Anatole Peter Kurkov (Ph.D. Thesis) 1967 98 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-7652

Two transient, one-dimensional, gaseous flame phenomena were investigated: the extinction of an initially undisturbed steady-state flame by a cold wall and the ignition of a reactant mixture by a hot surface. Series type solutions valid for limited times were obtained for both problems. For the flame extinction problem, the results were further extended in time by means of numerical integration of the governing equations. It was found for this problem that the amount of unreacted fuel at the wall depends significantly on the value of the Lewis number and only weakly on values of such kinetic parameters as the activation energy. Characteristic extinction time is closely related to the properties of the steady-state flame: it approximately equals the time it takes the steady-state flame to travel a distance of the order of about 15% of its thickness. Characteristic time for the ignition was found to depend exponentially on the activation energy and the wall temperature and is largely independent of the transport properties. Dissert. Abstr.

N69-15117 Oklahoma Univ., Norman.
IGNITION OF WOOD BY FLAME RADIATION
Ameer Nasser Koohyar (Ph.D. Thesis) 1968 269 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.50 Order 68-2142

A new experimental method for investigation of ignition phenomena of combustible solids was developed. In this method, the specimens were heated by direct radiation from free burning, buoyant, diffusion flames from liquid pools. Provisions were made so that the surface temperature and weight of the specimens were continuously measured and recorded. In the experimental phase of present study, slabs of five different species of wood were tested for pilot and spontaneous ignition. The experiments were carried out for various irradiance levels and under the conditions of both one-sided and two-sided (symmetrical) heating. Measurements were made for surface temperature, weight loss and ignition time for various levels of irradiance. The thermal properties of the samples were determined experimentally. Dissert. Abstr.

N69-15149 Michigan State Univ., East Lansing.
HYDRODYNAMIC AND HEAT TRANSFER CHARACTERISTICS OF A SOLAR HEATED AIR DUCT
Muhammad Anwer Malik (Ph.D. Thesis) 1967 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-7920

Two analytical solutions are developed for fully-developed turbulent flow in a smooth unsymmetrically heated rectangular duct. Two experimental ducts were built. The bottom for both of them was made of plywood and was insulated. The vertical walls were made of pieces of lumber. The top of one of the ducts was covered by a flat galvanized sheet. The other duct was covered by corrugated galvanized sheet. The second duct was used to estimate the increase in pressure drop and heat transfer when a flat top is substituted by a corrugated one. The ducts were used to determine intake losses, intake length and friction coefficients. For both the ducts the friction coefficient was found to depend on Reynolds number and relative roughness. The corrugated roof resulted in an increase in friction coefficient of about 40 per cent. The analytical results for the convective heat transfer coefficient for smooth duct successfully carried over to the rough duct when multiplied by a factor $\sqrt{f/f_0}$. Dissert. Abstr.

N69-15151 Minnesota Univ., Minneapolis.
LOCAL HEAT TRANSFER MEASUREMENTS FOR R-11 CONDENSING WITH AND WITHOUT THE PRESENCE OF A NONCONDENSING GAS
William Rudoy (Ph.D. Thesis) 1967 206 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-7378

An experimental investigation was performed to obtain local heat transfer characteristics for vapor condensing in the laminar film region from a turbulent mainstream flow downward inside a tube. Data was taken both for pure vapor condensation and for condensation in the presence of a noncondensing gas. The specific objectives were to measure local heat transfer characteristics for condensation as a function of the local values of the variables, such as liquid Reynolds number, mainstream Reynolds number, vapor concentration, and the other characteristic dimensionless groups of Schmidt and Prandtl number. These measurements were to be made both with and without the presence of a noncondensing gas. An analysis, based on the physical processes involved, would be made to obtain an equation for correlating the data. A comparison would be made using the local values of the variables and the average values of the variables to determine the accuracy of the use of average values. Dissert. Abstr.

N69-15163 Connecticut Univ., Storrs.
ANALYTICAL AND EXPERIMENTAL STUDY OF THREE PHASE HEAT TRANSFER WITH SIMULTANEOUS CONDENSING AND FREEZING ON COLD HORIZONTAL AND VERTICAL PLATES
William A. Olsen, Jr. (Ph.D. Thesis) 1967 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-1386

Two problems involving three phase heat transfer are considered in this thesis. They are steady state condensing and freezing on a vertical plate and transient condensing and freezing on an infinite horizontal plate. The problem of steady state condensing upon a very cold vertical plate, where freezing can occur, is considered. The analysis indicates that it is difficult to obtain a solid layer from a pure vapor no matter how cold the coolant. Low pressures and a low coolant thermal resistance are necessary in order to have some chance of obtaining a solid layer. Transient simultaneous condensing and freezing (melting) of a pure vapor upon an initially dry very cold horizontal plate of no thermal capacity is considered. The analysis indicates that a solidified layer forms on an infinite horizontal cold plate whenever the coolant is colder than the freezing temperature of the vapor. An exact solution to this three phase problem occurs when the wall temperature is constant. Dissert. Abstr.

N69-15164 Purdue Univ., Lafayette.
AN ANALYTICAL AND EXPERIMENTAL INVESTIGATION OF RADIANT HEAT EXCHANGE BETWEEN SIMPLY ARRANGED SURFACES
James Ray Schornhorst (Ph.D. Thesis) 1967 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-6357

The purpose of this work is to improve the accuracy and to provide some confidence in the analytical methods of predicting radiant heat exchange between surfaces having nonelementary emission and reflection characteristics. In this study the validity of the commonly used simple methods of radiant heat transfer analysis was examined by more detailed analysis and by an extensive experimental investigation. The radiant heat transfer problem was first formulated for a general enclosure with as few simplifying assumptions as possible. Then the problem was specialized for a simple geometry. Solutions for the local radiant heat flux and the incident flux were obtained for seven different models approximating the radiant characteristics of the surfaces. The models ranged from the simple diffuse, specular, and diffuse-specular constant property models to a very detailed directional emission and bi-directional reflection model. Dissert. Abstr.

N69-15165 Stanford Univ., Calif.
THE TURBULENT BOUNDARY LAYER ON A POROUS PLATE: EXPERIMENTAL HEAT TRANSFER WITH UNIFORM BLOWING AND SUCTION
Robert John Moffat (Ph.D. Thesis) 1967 136 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-6463

An apparatus was constructed for the study of heat transfer through a turbulent boundary layer with strong blowing and suction. The apparatus consists of an electrically heated porous plate of sintered bronze material divided into 24 individually controlled segments. The construction is such that the blowing, no-blowing, and suction cases can be tested with no modifications to the test plate assembly. Stanton Number variations due to blowing and suction were determined for values of the blowing fraction between −0.008 and +0.010 over the Reynolds Number range from 4.4 × 10⁵ to 2.3 × 10⁶. The data is believed to be accurate to within 0.0001 Stanton Number units over most of this range. The blowing fraction was held uniform along the plate for all tests as were plate temperature and free stream velocity. Dissert. Abstr.

N69-15209# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF THE EFFECT OF NEUTRON AND ELECTRON BOMBARDMENT ON THE HEAT TRANSFER AT LOW TEMPERATURES OF GERMANIUM AND OF SILICON [ETUDE DE L'EFFET DES IRRADIATIONS NEUTRONIQUE ET ELECTRONIQUE SUR LA CONDUCTIBILITE THERMIQUE AUX BASSES TEMPERATURES DU GERMANIUM ET DU SILICIUM]
Michel Vandevyver (Ph.D. Thesis) 1967 74 p refs In FRENCH
(CEA-R-3387) Avail: CFSTI

The main results obtained from this work are the following: (1) neutron irradiation (at 300°K) produces lattice defects in germanium and silicon, and a corresponding very large lowering of the thermal conductivity is observed in the low-temperature region (4 to 300°K). The results obtained have been explained with the help of the following hypotheses: —for silicon a scattering of phonons by the stress fields produced by the defects; —for germanium, a supplementary scattering of the electron-phonon type. (2) annealing treatments carried out on these materials above 373°K restored the thermal conductivity over the whole temperature range of the measurements (4 to 300°K); in the case of both germanium and silicon there were two steps in the annealing process. (3) a study of the thermal conductivity of germanium (initially P or N) after an electronic irradiation showed that the scattering of phonons could depend on the charge of the defects thus produced. Author (NSA)

N69-15297# California Univ., Los Angeles.
FLAMES: KINETICS AND SPECTROSCOPY Final Report, 1 Oct. 1964 -30 Sep. 1968
Kyle D. Bayes 30 Sep. 1968 9 p refs
(Grant AF-AFOSR-687-64)
(AD-677337; AFOSR-68-2199) Avail: CFSTI CSCL 21/2

A summary is given of work involving the chemiluminescence of low-pressure atomic flames. Several chemiluminescent reactions were established (including the O + C2O reaction); and the mechanism of energy transfer was established as the source of chemiluminescence in at least one flame. Also, a technique was developed to study the transition state involved in charge exchange between atomic ions and molecules. TAB

N69-15321# Eidgenossische Technische Hochschule, Zurich (Switzerland).
MEASUREMENT OF THERMAL CONDUCTIVITY IN LIQUID FREEZING MIXTURES WITH THE HELP OF A NONSTATIONARY HOT-WIRE PROCESS [MESSUNG DER WAERMELEITFAEHIGKEIT FLUESSIGER KAELTEMITTEL MIT EINEM INSTATIONAEREN HITZDRAHTVERFAHREN]
Willy Tauscher (Ph.D. Thesis) 1968 90 p refs In GERMAN
Its Dissertation No. 4144
Avail: CFSTI

Electric heated wires were used to measure the thermal conductivity of liquid synthetic refrigerants between −125°C to +100°C. Measured values for some halogen derivatives of low hydrocarbons were correlated with the functional temperature and the resulting homologous rows were then used to represent property data through mathematical methods. Transl. by G.G.

N69-15331# Rocket Propulsion Establishment, Westcott (England).
CONVECTIVE HEAT TRANSFER IN ROCKET ENGINES: PART 2, HEAT TRANSFER TO THE NOZZLE
R. C. Parkinson Dec. 1967 52 p refs
(RPE-TR-67/16/UL) Avail: CFSTI

An analysis was made of 624 experimental heat transfer results obtained for hot air flowing in convergent-divergent nozzles. A theory has been developed as an extension of the theory of heat transfer in a turbulent boundary layer to account for the effect of

laminatization in highly accelerated gas-streams, and also for the reduction in heat transfer rate observed in the supersonic regime of the nozzle. The values predicted by this extended theory are found to lie within a root-mean-square deviation of 14.5%, which is equal to the probable accuracy of the experimental results.
Author

N69-15359# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CONVECTIVE HEAT TRANSFER IN RADIATING GAS [KONVEKTIVNYY TEPLOOBMEN V IZUCHAYUSHCHEM GAZE]

V. V. Bogolepov et al. 9 Nov. 1967 23 p refs Transl. into ENGLISH from AN SSSR. Izv. Mekhan. Zhidkosti i Gaza, no. 5, 1966 p 23–29
(AD-678426; FTD-HT-23-977-67) Avail: CFSTI CSCL 20/4

The problem of convective heat transfer in a steady uniform hypersonic viscous gas flow past a blunt body is considered with radiation taken into account. A detailed analytical investigation of a certain form of boundary-layer equations and boundary conditions corresponding to flows with volume luminescence and nearly similar flow regimes with a shock layer of small optical thickness. The solutions were sought in the stagnation region by the method of external and internal expansions in the small parameter epsilon = rho sub infinity/rho (density ratio across the shock wave) at M approaching infinity, taking account of the emission and absorption of radiant energy. The equations and boundary conditions assume a different form, depending on which of the dissipative processes-heat conductivity or absorption of radiation by the gas is predominant in the narrow layer near the wall cooled at the expense of radiation. Solutions are presented for small but finite optical thicknesses of the inviscid shock layer and for the case when absorption is substantial only in the boundary layer and also for a feebly radiating gas with a shock layer of arbitrary thickness.
Author (TAB)

N69-15387*# Stevens Inst. of Tech., Hoboken, N. J. Dept. of Mechanical Engineering.

THE MECHANISM OF FLAME SPREADING OVER THE SURFACE OF INGNITING CONDENSED PHASE MATERIALS Annual Report

Robert F. McAlevy, III, Richard S. Magee, and Frank A. Lastrina Oct. 1968 38 p refs
(Grant NGR-31-003-014)
(NASA-CR-99084; ME-RT-68008) Avail: CFSTI CSCL 20M

A description of an experimental and theoretical investigation of the fundamental mechanism by which a flame spreads over the surface of a condensed phase material in a quiescent gaseous environment containing a component with which it can react chemically is presented. It is postulated that the advancing flame vaporizes the surface material lying before it. As these vapors diffuse away from the surface, they undergo an exothermic reaction with the gaseous environment, and ignite; thus, flame spreading is viewed as continuous diffusive, gas-phase ignition. Flame spreading velocities have been measured for a variety of solid materials in O_2/inert environments between 4 and 415 psia. Well defined experimental conditions yielded reproducible results and thus suggest that flame spreading velocity is an intrinsic combustion quantity.
Author

N69-15395# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STEADY-STATE RADIATIVE HEAT TRANSFER THROUGH A FINNED SURFACE WITH VARIABLE THERMAL CONDUCTIVITY OF THE MATERIAL

N. P. Belik et al. 15 Dec. 1967 9 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved., Aviats. Tekh. (Kazan), no. 1, 1967 p 61–64
(AD-678387; FTD-HT-23-1334-67) Avail: CFSTI CSCL 20/13

One of the missions of the Soviet scientific research program is the study of the properties of the terrestrial atmosphere by implementation of the Kosmos series artificial earth satellites (AES). These studies are directly related both to the problem of employing AES vehicles for weather forecasting and problems of a more general geophysical significance. Satellites are being used to obtain TV images of cloud systems and actinometric data with respect to the earths field of radiation. The launching of Kosmos 149 resulted in considerable information being obtained on the thermal regime of the earths atmosphere and clouds, quantitative cloud cover characteristics tied in with TV pictures, and angular and spectral characteristics of our planets brilliance as seen from space.
Author (TAB)

N69-15415# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE TRANSFER OF HEAT FROM A PLATE IN THE SUPERSONIC FLOW OF RAREFIED AIR

Yu. A. Koshmarov et al. 6 Nov. 1967 23 p refs Transl. into ENGLISH from Teplo i Massoperenos (Minsk), v. 2, 1965 p 170–188
(AD-678344; FTD-HT-23-1381-67) Avail: CFSTI CSCL 20/4

An investigation was made of the transfer of heat and the equilibrium temperature of a flat plate of limited thickness (limited in comparison with the mean molecular free path in the free gas stream), streamlined by a supersonic flow of rarefied air at a zero angle of attack. The models of the plate were of sufficient span to permit reference of the results of the investigations to the case of plane streamlining (plates of infinite span). The measurements of the heat-transfer coefficient and of the equilibrium temperatures were carried out at Mach number values ranging from 2.6 to 9. The investigations encompassed various streamlining conditions, beginning from the case in which the entire surface of the plate is subjected to virtually free-molecular gas flow and concluding with the case in which the flow of the gas over virtually the entire plate corresponds to the Navier-Stokes-Fourier continuum regime.
Author (TAB)

N69-15416# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF SOME CONDITIONS OF COMBUSTION ON THE ELECTRICAL CONDUCTIVITY OF A GAS-AIR TORCH

G. S. Golovina et al. 27 Dec. 1967 10 p refs Transl. into ENGLISH from Akad. Nauk SSSR. Inst. Goryuch. Iskop., Novyye Metody Szhiganiya Topliv i Vopr. Teorii Goreniya (Moscow), 1965 p 120–125
(AD-678348; FTD-HT-23-1197-67) Avail: CFSTI CSCL 20/3

The effect of the air excess factor and the rate of gas flow on electrical conductivity in methane-air flames were investigated. The experimental setup is shown. The maximum electrical conductivity of the flame falls within alpha = 0.8-1.0; alpha is the air excess coefficient. It was found that the magnitude and distribution of electrical conductivity in the flame depends upon the flow rate of the combustible gas mixture. An increase in the flow rate of air-rich mixtures results in higher maximum electrical flame conductivity while the reverse is true for air-lean mixtures. The dependence of the magnitude of the maximum electrical current upon alpha is shown. The dependence of the maximum current along the flame axis upon gas mixture flow rate at various alphas and electron current between the rate at various air excess coefficients are graphed.
Author (TAB)

N69-15442 California Univ., San Diego.

THEORETICAL STUDIES ON CONDUCTIVE, CONVECTIVE AND RADIATIVE HEAT TRANSFER

Om Prakash Sharma (Ph.D. Thesis) 1967 177 p
Avail: Univ. Microfilms: HC $9.20/Microfilm $3.00 Order No. 68-6988

Formulations and the solutions of six diverse heat transfer problems are given. Chapter I contains a description of simplified procedures for the approximate solution of heat-transfer problems.

with phase change for time-dependent surface temperatures. In Chapter II, a study of thermal stress development in partially transparent rods is done by using a laser source for controlled energy deposition. Chapter III describes some interesting heat-transfer problems with moving boundaries for which extract or approximate solutions may be found by the use of elementary analytical techniques. Chapter IV contains the description of a numerical iteration scheme for the solution of similar boundary layers with hydrogen injection and with chemical behavior idealized according to the flame-sheet model, and describes approximate procedures for correcting the analytical results based on simplified transport properties. In Chapter V, an approximate analytical procedure is developed for deriving relations between ablation rate and surface temperature. Finally, in Chapter VI, some earlier simplified procedures of making a connection between isothermal (band or total) emissivity tabulation and radiant-energy emission from nonuniform gases have been refined. Dissert. Abstr.

N69-15449# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

DETERMINING THE TEMPERATURE FIELD IN A FINITE CYLINDRICAL SHELL

Sh. M. Bakhyshev 16 Feb. 1968 12 p Transl. into ENGLISH from Izv. Akad. Nauk Azerb. SSR, Ser. Fiz.-Mat. i Tekhn. Nauk (Baku), no. 4, 1966 p 28-34

(AD-678403; FTD-HT-23-1440-67) Avail: CFSTI CSCL 13/13

Thermal stress distribution in a thin circular cylindrical shell caused by its nonuniform heating is examined. The shell is isotropic, the temperatures inside and outside the shell are different and vary along the longitude of the shell, and with time. Determining the temperature at any point of the shell is reduced to solving the heat-conductivity equation which satisfies the boundary and initial conditions. Author (TAB)

N69-15471# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

SOLUTIONS OF DIFFERENTIAL EQUATIONS FOR THERMAL-STRESS ANALYSIS OF AN OGIVAL RADOME

Manford B. Tate Aug. 1968 22 p refs

(Contract NOw-62-0604)

(AD-677273, APL-TG-1009) Avail: CFSTI CSCL 17/9

General solutions for the shearing-stress resultant and change in slope of the radome wall are obtained and described. These are the basic functions that are required in the calculation of thermal stresses. They are obtained in the form of infinite series for a bicentric-ogive radome mainbody. Sets of coefficients for the series are determined from recurrence formulas that are well suited to computer programming. In numerical work, two-hundred terms were employed to evaluate all sums at several points along the span of the radome. Two intervals of expansion were found necessary for absolute convergence of the series in the ogival mainbody. Author (TAB)

N69-15580# General Electric Co., Cincinnati, Ohio. Missile and Space Div.

A BRIEF PROGRAMMER'S INTRODUCTION TO VERSION E OF THE TRANSIENT HEAT TRANSFER COMPUTER PROGRAMS (NMP-857)

S. C. Skirvin 1 Jul. 1968 59 p refs

(Contract AT(40-1)-2847)

(GEMP-616) Avail: CFSTI

A brief, programmer-oriented description is given of the Transient Heat Transfer digital computer programs. THTE provides a solution capability for large, complex three-dimensional transient and steady-state heat transfer problems which can include conduction, convection, and radiation with the option to compute fluid flow rates on a one-dimensional basis. THTE is coded in the FORTRAN-IV language, but employs list-processing concepts unusual for this language; these are described in detail. The availability status is outlined. Author (NSA)

N69-15585# Technische Hochschule Stuttgart (West Germany). Arbeitsgemeinschaft fuer Raketentechnik und Raumfahrt.

MEASUREMENT OF HEAT TRANSFER IN ROCKET ENGINES. PART 2: RESULTS AND COMPARISON WITH THEORETICAL CALCULATIONS [WAERMEUEBERGANGS-MESSUNGEN AN REKETENTRIEBWERKEN. TEIL 2: MES-SERGEBNISSE UND VERGLEICH MIT THEORETISCHEN BERECHNUNGEN]

Eugen Schaefer Dec. 1968 49 p refs In GERMAN

(AGRR-TB-17) Avail: CFSTI

Analyses of stationary heat transfer measurements on rocket engines and comparison with theoretical values obtained by approximation methods showed generally good agreement. The only differences were observed in the location of highest heat transfer; measurements placed these values before the nozzle throat whereas the theoretical determined heat transfer maximum was in the nozzle throat. Transl. by G.G.

N69-15614# Institut Franco-Allemand de Recherches, St. Louis (France).

EROSION DUE TO THE COOLING OF HIGH TEMPERATURE GASES UNDER HIGH PRESSURE [DIE EROSION DURCH STROEMENDE HOCHGESPANNTE HEISSE GASE]

W. Kegler and D. Grune 18 Sep. 1968 49 p refs In GERMAN

(ISL-6/68) Avail: CFSTI

Experimental data were obtained on the reaction mechanism of erosion under conditions closely simulating those in the barrel of a weapon. A combustion bomb permitting pressure measurements up to 6000 kp/cm^2, a gas ignition system, and an erosion cylinder with a conical inlet nozzle were used in the tests. The gas pressure was controlled by a piezoelectric device. Reproducibility of the erosion measurements was greatly enhanced through the use of gas ignition and the conical inlet nozzle. A characteristic erosion value for this device was derived which is a function of explosion temperature, mean molecular weight, and the adiabatic exponent of the combustion gases. This value constitutes the maximum erosion per gram of propellant which results from a charge of 14,500 cal. After linearization, this function can be used to classify all conventional propellants and derive therefrom the erosion value. Transl. by K.W.

N69-15621#

INVESTIGATION OF HEAT EXCHANGE, TAKING ACCOUNT OF RADIATION, FOR GAS FLOW IN A TUBE

V. N. Velutskii et al [1968] 9 p refs Transl. into ENGLISH from Prikl. Mekh. i Tekhn. Fiz. (USSR), no. 5, 1968 p 82-88

Avail: CFSTI

Taking account of energy transfer by radiation, the nonisothermal flow of a real gas was computed for the case of a strong frequency dependence of the absorption coefficient by using derived approximate hydrodynamics equations. Hydrogen flow at a 100 atm pressure was examined for a more complete clarification of the role of reabsorption radiation. It was shown that radiation introduces a noticeable contribution to the heat flux at the wall for temperatures at 9000 °K in a 0.3 cm radius tube, and to 6500 °K in a 3 cm radius tube. Similarity in the temperature profiles in various modifications was observed at a temperature below 5000 °K on the axis. Author

N69-15628 Illinois Univ., Urbana.

PREDICTION OF THE MACROSCOPIC CONTACT AREA IN THERMAL CONTACT RESISTANCE

Ross Orlo McNary (Ph.D. Thesis) 1967 111 p

Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-8165

A new method is developed which successfully predicts the macroscopic contact area for a wide variety of geometries. The magnitude of the error in the macroscopic contact resistance which may result from simplified models is demonstrated. The effect of thin members and the effect of large scale surface waviness is also reported. The method of solution to this contact problem in

elasticity is a numerical one. A physical lumped-parameter model is employed from which the finite difference equations in terms of displacements are derived. Modifications to an existing physical model were made which resulted in an increase in accuracy and a decrease in the necessary computation time. This method can be employed for many elasticity problems with good accuracy using a relatively coarse nodal system. For large numbers of equations, a method of solving the simultaneous algebraic equations is suggested which has been found to be both rapid and accurate.
Dissert. Abstr.

N69-15663 Ohio State Univ., Columbus.
EFFECT OF ELECTROMAGNETIC WAVE RADIATION ON THE ENERGY TRANSMISSION OF PARTIALLY TRANSPARENT MATERIAL
Robert Emmett Manning (Ph.D. Thesis) 1967 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-8853

The general theory is first established from the fundamentals of thermodynamics and electromagnetic theory. Then the energy equations are established and the physical mechanisms involved are described. In particular, the theory and resulting energy equations are applied to a general physical configuration—a slab of multilayers of different homogeneous and isotropic materials. Each of these layers is characterized mainly by three parameters: the complex refractive index of the material which consists of two parts—the ordinary refractive index and the absorption coefficient, the thermal conductivity of the material, and the length of the layer. The general physical process consists of the following: There is electromagnetic radiation incident on one side of the multilayer structure. Some of this radiation is reflected from the slab, some is transmitted through the slab, and some is absorbed in each of the layers of the slab. There are in general multiple reflections and transmissions at each interface of the slab. The part that is absorbed is conducted to the outside surfaces where it is transported to the ambient by thermal conduction and thermal convection. The specific problem investigated in this study is the case of one plane-polarized monochromatic wave normally incident on the slab. The frequency of this wave is in the optical range (infra-red, visible, ultra-violet).
Dissert. Abstr.

N69-15670*# Aztec School of Languages, Inc., Acton, Mass.
CALCULATION OF A MODEL OF POROUS BODY AT HIGH TEMPERATURES [K RASCHETU MODELI PORISTOGO TELA PRI VYSOKIKH TEMPERATURAKH]
S. P. Detkov Washington NASA Nov. 1968 14 p refs Transl. into ENGLISH from Zh. Prikl. Mekhan. i Tekhn. Fiz (Moscow), no. 1, 1968 p 105–121
(Contract NASw-1692)
(NASA-TT-F-11990) Avail: CFSTI CSCL 20M

The article discusses a model in which a porous body is represented by a system of identical axisymmetric channels in a continuum. The temperature gradient coincides with the channel axis, while the thermal resistance is increased by passing a gas or liquid through the channels. The heat flux is determined by calculating the temperature field (the temperature field is also used to obtain information concerning the behavior of the material). The discussion is limited to steady-state heat transfer. The heat flux values are obtained under the following assumptions: local thermodynamic equilibrium, gray and diffuse radiation, nontransparent walls, and isotropic scattering.
Author

N69-15676 Princeton Univ., N. J.
AXIAL MODE SHOCK WAVE COMBUSTION INSTABILITY IN LIQUID PROPELLANT ROCKET ENGINES
Charles E. Mitchell (Ph.D. Thesis) 1967 192 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 68-8951

Axial mode combustion instability in liquid rocket combustors is investigated, analytically, with the combustion processes represented using the Crocco time-lag concept. Periodic oscillations of finite amplitude, both continuous and discontinuous in form, are studied. Two types of combustion distribution are considered. The first is the limiting case where the combustion can be taken to be concentrated at the injector face. The second occurs when the combustion is sufficiently distributed so that the derivative of the steady-state velocity is of the same order as the steady-state velocity itself. For either type of combustion distribution both continuous and discontinuous pressure waves are predicted for values of the combustion feedback parameters that are in the range of practical interest.
Dissert. Abstr.

N69-15678 Minnesota Univ., Minneapolis.
CONVECTIVE INSTABILITY IN A TEMPERATURE AND CONCENTRATION FIELD
Ching-Cheng Shir (Ph.D. Thesis) 1967 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-7384

This thesis deals with the theory of convective instability in a physical system exhibiting heat and mass transfer. The method of energy is extended to these problems with coupled scalar fields by the use of variational principles, function-space methods, parametric differentiation and numerical computations. The result is a mathematically rigorous formalism from which one can deduce sufficient conditions under which the energy of a difference motion will surely decrease. Given are: (1) an explicit *a priori* estimate of stability, (2) an improved stability criterion following from the formulation of a maximum problem, (3) a general description of the optimum stability boundary and its variation with parameters, (4) an analysis of a fluid layer with heat and mass transfer, (5) an analysis of a plane Couette flow heated from above, (6) an analysis of a fluid layer with unsteady mean temperature distribution (including the cases of suddenly heated from below, suddenly and linearly cooled from above).
Dissert. Abstr.

N69-15701*# Techtran Corp., Glen Burnie, Md.
AN APPLICATION OF THE POWER SERIES METHOD TO SOLUTION OF THE FIRST BOUNDARY VALUE PROBLEM FOR AN EQUATION OF A PARABOLIC TYPE
P. F. Filchakov et al 1968 6 p Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR, Ser. A (Kiev), v. 29, Nov. 1967 p 1034–1039
(Contract NAS5-14826)
(NASA-CR-99126) Avail: CFSTI CSCL 20M

The solution of a non-homogeneous partial differential equation is sought by the power series method. The Laplacian transformation reversion is realized numerically. The calculation technique can be carried out by usual small computers, an arithmometer included, and by electronic computers too.
Author

N69-15707*# Massachusetts Inst. of Tech., Cambridge. Heat Transfer Lab.
REFRIGERANT FORCED-CONVECTION CONDENSATION INSIDE HORIZONTAL TUBES
Soonhoon Bae, John S. Maulbetsch, and Warren M. Rohsenow 1 Nov. 1968 82 p refs
(Grant ASHRAE-G-RP-63)
(DSR-79760-59) Avail: Issuing Activity

Condensing heat transfer rates inside a horizontal tube were investigated for large quality changes across the tube. The result of the investigation is modified through new variables which include the effect of the true axial pressure gradient in a tube. Experimental data are presented for a range of flow conditions. A long nickel tube was used for condensing Refrigerant-12. The saturation temperature was varied from 84.6°F to 110°F and flow rates of vapor-liquid mixture ranged from 151,000 lbm/ft-hr to 555,000 lbm/ft-hr. The inlet quality was essentially 100% at saturation and exit qualities ranged from 80% to zero and subcooled liquid. The test results for average heat transfer coefficient were correlated by the analysis within 15%.
Author

N69-15732# Argonne National Lab., Ill.
A PROGRAM FOR THE STATISTICAL ANALYSIS OF DEFECTS IN NONSTOICHIOMETRIC METAL OXIDES (62E8207)
A. J. Strecok and L. M. Atlas Jun. 1968 19 p refs
(Contract W-31-109-ENG-38)
(ANL-7449) Avail: CFSTI

The defects in an equilibrium assembly in a nonstoichiometric metal oxide have a characteristic distribution over the possible range of spacings and energies. The distribution may be calculated by a statistical system that divides the spacing and energy ranges into discrete levels by means of the spacing parameter. A program is described and listed for the required computations and the estimation of thermodynamic quantities. NSA

N69-15749*# National Bureau of Standards, Boulder, Colo. Inst. for Basic Standards.
THERMODYNAMIC AND RELATED PROPERTIES OF OXYGEN FROM THE TRIPLE POINT TO 300 K AT PRESSURES TO 330 ATMOSPHERES
L. A. Weber 20 Jun. 1968 113 p refs
(NASA Order R-06-006-046; NBS Proj. 22504-2250445)
(NASA-CR-99159; NBS-9710) Avail: CFSTI CSCL 07D

The results of new experimental pressure-volume-temperature measurements on oxygen are presented. The data range in temperature from 54 to 300 K and in pressure from 1 to about 330 atm. The following properties are tabulated for selected isobats: molar volume, $(\partial P/\partial \rho)_T$, $(\partial P/\partial T)_\rho$, internal energy, enthalpy, entropy, specific heats at constant volume and at constant pressure, and the velocity of sound. Additional tables present the above properties for saturated liquid and vapor, the freezing liquid P-V-T relationship, and the derived Joule–Thomson inversion curve. New values for the critical density and triple point density are presented, and the second and third virial coefficients are tabulated. Author

N69-15770# Union Carbide Nuclear Co., Oak Ridge, Tenn. Computing Technology Center.
GAS HEAT EXCHANGER PROGRAM (GHEP)
Randall C. De Lozier 11 Oct. 1968 133 p refs
(Contract W-7405-ENG-26)
(K-1750) Avail: CFSTI

A FORTRAN coded gas heat exchange program (GHEP) that was developed as a design aid in minimizing the costs of energy removal in a gas cooling process is described. Water was used as a coolant, and air was selected as the gas heat transfer media in these studies; however, the program is general to facilitate the use of other gases and coolants. Provisions of the program include the ability to study the effect of gas cooler parameters on the total cost of the system. The total cost is based on gas heat losses, coolant heat losses, pumping cost, and the amortized sum of the capital costs of the energy removal system. Instructions for using GHEP and a sample problem (designing an air cooler with energy recovery) with input and output sheets are included. Author (NSA)

N69-15809 Institut Franco-Allemand de Recherches, St. Louis (France).
INTERACTIONS BETWEEN THE FLOW OF HEAT AND THE ABLATION BY FUSION [INTERACTIONS ENTRE LES FLUX DE CHALEUR ET L'ABLATION PAR FUSION]
J. Lumeau [1968] 35 p refs In FRENCH Presented at the 5th Colloq. d'Aerodynamique Appl., Poitiers, France, 6–8 Nov. 1968
(ISL-T-37/68) Avail: CFSTI

Duraluminum spheres, 8 mm in diameter, were launched into a reentry simulator with the aid of a light gas gun. The combustion heat flow, sensitive to increasing air density encountered by the spheres along their trajectory, rapidly dominated the convective heat flow which decreased with speed. Under such conditions the models underwent a strong melting ablation and evolved towards a conical ogive shape. The liquid layer of the molten metal was the origin of the interaction between incoming heat flux and ablation initiation. The combustion is conditioned by the laminar or turbulent nature of this liquid film. Transl. by B.P.

N69-15834# Joint Publications Research Service, Washington, D. C.
ON THE TRANSITION OF A PLANE OVERDRIVEN DETONATION WAVE TO THE CHAPMAN–JOUQUET MODE
V. A. Levin 27 Dec. 1968 13 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekhan. Zhidkosti i Gaza (Moscow), no. 2, Mar.–Apr. 1968 p 50–55
(JPRS-47151) Avail: CFSTI

The propagation of plane detonation waves occurring with the flow of a combustible gas mixture around a solid body is considered, taking into account the final speed of the chemical reactions. The purpose of the calculations is to establish why the overdriven detonation wave forming in front of the body breaks up into a usual compression jump and a slow combustion front, instead of taking on the Chapman–Jouquet mode. Models are constructed for nonstanding and standing plane waves. The calculations indicate that, with the mixtures being considered, the transition to the Chapman–Jouquet mode is not possible in the range of the models used. Experiments with shooting bodies through hydrogen–air, oxygen–hydrogen and other gas mixtures confirm this. The physical reason appears to be the instability of the detonation wave which results in its separation into the usual compression jump and slow combustion front. A.C.R.

N69-15841# Interior Dept., Washington, D. C. Library.
INVESTIGATION OF HEAT TRANSFER IN VAPOR CONDENSATION IN VERTICAL PACKED TUBES
B. G. Bergo et al [1968] 2p ref Transl. into ENGLISH from Khim. i Neftyanoe Mashinostr. (USSR), no. 4, Apr. 1965 p 27–28
(PB-179635T) Avail: CFSTI CSCL 07A

An investigation of the heat transfer process in the condensation of vapor in vertical packed tubes was performed. The first series of experiments were performed for the empty tube in order to check the accuracy of the experimental method. The second series of experiments were performed with the aim of determining the dependence of the coefficient of heat transfer in vapor condensation in a packed tube on the reflux density and the velocity of vapor in the tube. Most of the experiments were performed with the aim of determining the dependence of the heat transfer coefficient in vapor condensation in a packed tube on the difference between the temperatures of condensing vapor and the inside surface of the tube wall. USGRDR

N69-15905*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THERMODYNAMICS OF MULTISTAGE CYCLES OF MHD APPARATUS WITH HEAT REGENERATION
E. E. Shpil'Rayn et al 1968 13 p refs Transl. into ENGLISH from Russian
(Contract NAS7-100)
(NASA-CR-99115) Avail: CFSTI CSCL 20M

The cycles of liquid-metal power apparatus with a single-component rotor are analyzed. An examination is made of the basic factors leading to reduced effectiveness of the cycle when the cold liquid is supplied in one stage, injection system. Multistage systems are proposed, both in the injector and in the separational form with heat regeneration; these systems make it possible for the power apparatus to operate in a wide range of dryness. It is found that the effective efficiency of these cycles lies at a level of 12 to 14%. Author

N69-15934# Aerojet-General Corp., San Ramon, Calif. Nuclear Div.
THERMOPHYSICAL AND HEAT TRANSFER PROPERTIES OF ALKALI METALS. VOLUME 2
P. Y. Achener, W. V. Meckewicz, D. Yee, and D. C. Camp Aug. 1968 387 p refs

(Contract AT(04-3)-368)
(AGN-8195-VOL-2) Avail: CFSTI

The causes and magnitude of differences in the heat transfer characteristics of alkali metals and those of ordinary fluids are examined. An extensive literature review was performed, and selected data on the heat transfer properties of alkali metals are presented. Empirical correlations or theoretical solutions are recommended only when they are reasonably verified by several sets of data. Separate discussions are presented for: forced convection heat transfer with laminar flow, with turbulent flow, and to fluids outside tubes; boiling heat transfer; and condensing heat transfer. NSA

N69-15958*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMBUSTION IN SOLID-PROPELLANT ROCKET ENGINES [SPALANIE W SILNIKACH RAKIETOWYCH NA PALIWO STALE]
Antoni Jankowski 1968 16 p refs Transl. into ENGLISH from Tech. Lognicza i Astronautyczna (Warsaw), v. 22, Feb. 1967 p 5-9
(Contract NAS7-100)
(NASA-CR-99108) Avail: CFSTI CSCL 21B

The problems involved in the process of combustion of solid-propellant rocket engines are surveyed with a description of the important factors influencing the combustion rate. The effects of the following parameters are examined: pressure, fuel temperature, flow velocity over the burning surface, fuel composition, grain dimensions of the oxidizer, heat transfer through radiation, fuel and combustion chamber dimensions, manufacturing criteria, and catalysts. The combustion process is described in terms of a mathematical model for combustion of homogeneous and complex fuels and by a model for unstable combustion under certain given conditions. The sources of instability and causes of combustion rate variations are described for unstable combustion conditions. Author

N69-16066# Joint Publications Research Service, Washington, D. C.
SUPERTHERMAL CONDUCTIVITY: THE HEAT TUBE, A "THERMAL TRANSFORMER"
Ye. Muslin 31 Dec. 1968 6 p Transl. into ENGLISH from Znanie Sila (Moscow), no. 10, Oct. 1968 p 22-23
(JPRS-47165) Avail: CFSTI

Brief review of the heat tube and superthermal conductivity is presented. The heat tube has thin walls and tightly sealed ends from which air has been evacuated. Inside is placed a porous material, impregnated with some kind of volatile liquid. The superthermal conductor acts in this way: one end of the tube heats up, the enclosed liquid vaporizes, and the steam, due to the difference in pressure, passes to the other end. Here it condenses and gives up heat to the colder wall, while the liquid along the capillaries in the porous material returns to the dry area. The physics of the operation is briefly discussed and engineering and other technological implications are mentioned. B.P.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-15413*# George Washington Univ., Washington, D. C.
THE NEW TECHNOLOGICAL ERA: A VIEW FROM THE LAW
Harold P. Green Jan. 1968 12 p *Its* Monograph No. 1
(Grant NGL-09-010-030)
(NASA-CR-99039) Avail: CFSTI CSCL 05D

The problem of protecting society from the hazards of technology, e.g., unemployment, excessive leisure, changes in moral or social standards, etc. is considered. The law's involvement in imposing constraints on technological progress has been mainly a trial and error process. The legal system traditionally has dealt with these problems only after they are shown to exist. Consideration is given to the capabilities and implications of determining whether the legal system is capable of imposing effective social control over new technologies before they inflict very substantial, or even irreparable injury, upon society. The challenge to protect people against technology requires that protective measures be built into the development and practice of technology. B.P.

N69-15708*# National Aeronautics and Space Administration, Washington, D. C.
SIXTEENTH SEMIANNUAL REPORT TO CONGRESS, 1 JULY-31 DECEMBER 1966
31 Dec. 1966 290 p refs
(NASA-TM-X-61375) Avail: SOD $1.50; CFSTI CSCL 22

NASA activities and accomplishments are reviewed in the areas of manned space flights, scientific space investigations, applications technology satellites, advanced research and technology programs, nuclear propulsion and power generation, tracking and data acquisition, international cooperation, grants, information and education programs, personnel, management, procurement, and support functions. During this period the Gemini program was successfully completed with the Gemini X, XI, and XII flights. Lunar Orbiters I and II transmitted thousands of clear pictures of the moon. Intelsat II was orbited for the Communications Satellite Corporation, extending the network of commercial communications satellites and linking Hawaii with continental United States. The first Applications Technology satellite carried advanced meteorological and communications experiments into orbit. B.P.

N69-15712*# National Aeronautics and Space Administration, Washington, D. C.
SEVENTEENTH SEMIANNUAL REPORT TO CONGRESS, 1 JANUARY-30 JUNE 1967
30 Jun. 1967 277 p refs
(NASA-TM-X-61374) Avail: SOD $1.50; CFSTI CSCL 22

This period involved intensive development efforts on the Apollo spacecraft and the Saturn V launch vehicle, and was marked by a fire during a ground test of this spacecraft which claimed the lives of three astronauts. The Gemini program was closed out. Orbiting Solar Observatories monitor processes taking place within the sun, and Orbiting Geophysical Observatories are measuring the earth's magnetosphere and its upper atmosphere. The Lunar Orbiter and Surveyor spacecraft have paved the way for exploration of the moon by pinpointing possible landing sites for astronauts and by sampling its surface; Mariner spacecraft have furnished data on Mars and Venus. The first Applications Technology Satellite supplied data on tropical cloud motions and air circulations, took part in voice communications between aircraft and ground stations, and helped telecast a program by 17 nations reaching an estimated 14% of the world's population. Weather and geodetic satellites also provided a multitude of information. The above are some of the highlights from the NASA report to Congress for this period. B.P.

N69-15713*# National Aeronautics and Space Administration, Washington, D. C.
EIGHTEENTH SEMIANNUAL REPORT TO CONGRESS, 1 JULY-31 DECEMBER 1967
31 Dec. 1967 258 p refs
(NASA-TM-X-61384) Avail: SOD $1.25; CFSTI CSCL 22

The major achievement of the reporting period in the Manned Space Flight Program was the successful first unmanned flight test of the Apollo-Saturn V space vehicle on November 9. Emphasis was continued on the technical and engineering improvements identified as necessary following the Apollo 204 accident. Further progress was made in improving the management efforts, organization, and operating procedures associated with the Apollo

Program, in addition to the design changes in the spacecraft itself. An interplanetary Explorer and a Pioneer space probe were launched. Other complex spacecraft launched were the last of the Lunar Orbiter photographic laboratories, three Surveyor soft lunar landers, Mariner V which flew by Venus, and the second Biosatellite. Also reviewed are the basic research programs, nuclear systems and space power activities, tracking and data acquisition, and all other accomplishments connected with the NASA space program. B.P.

N69-15778# Naval Personnel Research Activity, San Diego, Calif.
CATALOG OF PERSONNEL COST DEFINITIONS AND CONCEPTS FOR THE DERIVATION OF MAN/MACHINE FUNCTION ALLOCATION FORMULAE Final Report
Marilee N. Connelly Oct. 1968 50 p refs
(AD-678347; SRM-69-8) Avail: CFSTI CSCL 14/1

This project is directed toward the development of a personnel cost/effectiveness methodology for use in man/machine function primarily during the early stages of equipment system design. The specific purpose of this report is to define and to present a catalog of cost, personnel, and function allocation concepts which are relevant to the development of the cost analysis parameters for man/machine function allocation. Author (TAB)

N69-15837# Joint Publications Research Service, Washington, D. C.
SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 195
26 Dec. 1968 59 p refs Transl. into ENGLISH from Russian
(JPRS-47142) Avail: CFSTI

U.S.S.R. publications in the field of geophysical, astronomical, and space research are reviewed. Astronomical topics include periodic modulation studies of solar radio emission and proper motions of multicenter sunspot groups. Abstracts on wind, cloud, and atmospheric radiation variations are included, as well as boundary layer movements and meteorological disturbances. Seismic studies of earth tremors, attenuation of shock wave energy in rocks, and crustal thickness determinations using surface wave velocities are summarized. Tsunamic sea movements and Black Sea sediment composition were also studied. Cosmic ray and meteorological data obtained from satellite flights are described. A.C.R.

N69-15868*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AERO-ASTRODYNAMICS RESEARCH REVIEW
William D. Murphree, ed. 15 Oct. 1968 263 p refs
(NASA-TM-X-53782; RR-7) Avail: CFSTI CSCL 23

Data are presented on research which is considered to have reached a milestone worthy of note. The areas covered include acoustics, atmospheric physics, celestial mechanics, flight mechanics, fluid dynamics, solar physics, operations analysis, and statistical analysis. Also included are the titles and abstracts of the reports and papers which were prepared from July 1967 through 1968. Author

N69-15907# National Aeronautics and Space Council, Washington, D. C.
UNITED STATES AERONAUTICS AND SPACE ACTIVITIES, 1968
Jan. 1969 122 p refs
Avail: SOD $1.25

Significant achievements in aeronautics and in space, culminating in the epochal Apollo 8 flight, are reviewed. Interdepartmental and interagency cooperation is discussed in relation to the programs between NASA and the Department of Defense, Atomic Energy Commission, Department of State, Department of Commerce, Department of Transportation, Federal Communications Commission, United States Information Agency, and the Arms Control and Disarmament Agency. The advisory roles played by the National Aeronautics and Space Council, the National Science Foundation, National Research Council, National Academy of Engineering, and the Smithsonian Astrophysical Observatory are reported. An overview is presented on international cooperation on space programs, and on Soviet achievements. Budget data are included. M.G.J.

N69-15927# Iowa State Univ., of Science and Technology, Ames.
CERAMIC AND MECHANICAL ENGINEERING, CHEMICAL ENGINEERING, CHEMISTRY, MATHEMATICS AND COMPUTER SCIENCE, METALLURGY, PHYSICS, AND REACTOR DIVISIONS Annual Summary Research Report, 1 JUL. 1967–30 JUN. 1968
Jul. 1968 442 p refs
(Contract W-7405-ENG-82)
(IS-1900) Avail: CFSTI

Individual abstracts were prepared for the research summaries of each of the 7 Ames Laboratory divisions. NSA

N69-15955# Joint Publications Research Service, Washington, D. C.
SYSTEMATIC STRUCTURAL APPROACH AND THE SPECIFIC NATURE OF PHILOSOPHICAL KNOWLEDGE
V. S. Tyukhtin 9 Jan. 1969 20 p Transl. into ENGLISH from Vopr. Filosofii (Moscow), 1968 p 47-58
(JPRS-47223) Avail: CFSTI

Special features involved in applying the systematic-structural principle to specific sciences and to methodological philosophical research are discussed. The systematic-structural approach in scientific knowledge is described, and it is emphasized that the problems in applying the approach are substantially connected to elaboration and application of mathematical methods to the material of modern science. Two aspects are delimited in philosophical categories and special scientific concepts: 1) the ontological; and 2) the logical and gnosiological. Depending on the predominance of one or the other of these concepts, all methodological philosophical problems are divided into one of two groups. A distinction is made between philosophical categories and special scientific and mathematical concepts. Finally, the cognitive function of philosophical categories and their elaboration in the light of systematic approach are treated. A.C.R.

N69-16059# European Space Technology Center, Noordwijk (Netherlands). Large Satellite Div.
THE COORDINATION OF RESOURCES APPLIED TO THE SINGLE AXIS SIMULATOR
J. W. Davis Paris ESRO Dec. 1968 12 p
(ESRO-TM-P-77(ESTEC)) Avail: CFSTI

An attempt is made in this paper to evaluate the basic problems associated with the planning and coordination of a definable project with particular reference to the use of Pert. Author (ESRO)

N69-16064*# Techtran Corp., Glen Burnie, Md.
UTILIZATION OF GODDARD AND IITRI FORMULAE FOR THE EVALUATION OF THE COST OF SATELLITES: APPLICATION TO THE ESRO PROGRAMS
J. F. Lafay 1968 18 p refs /ts ESRO Intern. Working Paper No. 277
(Contract NAS5-14826)
(NASA-CR-99132) Avail: CFSTI CSCL 05C

The total cost of an ESRO or NASA satellite program C_p includes the development cost of the satellite C_s which in turn includes the spacecraft cost C_{sc} and costs of scientific experiments C_e; the support cost for the mission C_{ms}; the cost of developing new testing installations and the location cost for existing test installations C_t; the cost of the launch vehicle and the launch expenses for this vehicle C_l; and the cost of personnel C_{mp}. The established Goddard and IITRI formulas are then examined, analyzed for errors, and applied to the above cost relationship for ESRO satellite programs. B.P.

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